

# The Southern Surgeon

Subscription in the United States, \$5.00

Vol. IX, No. 10

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October, 1940

## BREAST TUMORS

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THE differential diagnosis of benign and malignant breast tumors has been, and will continue to be, a subject of increasing importance. Thirty years ago 90 per cent of the patients who consulted a physician on account of a lump in the breast, had a malignant tumor, in most instances incurable; in the remaining 10 per cent the tumor was benign. Today 50 per cent of the breast tumors presented are benign, and 50 per cent are malignant, frequently curable. This change indicates the results of educating the public as to the advantage of an early examination.

When a patient with a breast tumor consults a physician, the questions which must be answered are:

Is the growth benign or malignant?

If benign, is it precancerous?

If malignant, can it be cured?

Is it operable?

Are there any lymph node metastases?

Are there metastases to lungs, liver or skeletal system?

Should irradiation be given before surgery, before and after surgery, or is irradiation alone indicated?

To answer these questions accurately one must necessarily have a working knowledge of the subject and that knowledge must be up-to-date.

At the Sheffield Cancer Clinic in Atlanta, since its organization six years ago, we have observed 357 tumors of the breast, and to this list the senior author has added his personal series of 70 pa-

From the Sheffield Cancer Clinic.

Presented, with motion pictures in color, before the Postgraduate Surgical Assembly (the eleventh annual meeting) of The Southeastern Surgical Congress, Birmingham, March 11, 12 and 13, 1940.

tients, making a total of 427 cases. Of this number 215, or 50 per cent, were benign and 212, or 50 per cent, malignant.

The diagnostic measures in ordinary use in determining whether a tumor is benign or malignant, according to the textbooks are:

1. History of the patient.
2. Physical examination.
3. Transillumination.
4. X-ray examination.
5. Biopsy: (a) aspiration, (b) excision.

In our opinion the history is, in most instances, worse than useless: in fact it is often misleading. Many patients have come to you and to us, with a tumor of the breast which has all indications of malignancy, often of late malignancy, and the patient states it has been present only two or three weeks. The history is valuable only when the patient knows positively that the tumor has been present for a number of years and is not growing.

The physical examination is essential because it discloses numerous important facts. The patient, with bare chest, should be examined thoroughly both sitting and recumbent. Examine both breasts, but examine the normal one first. In cases of suspected cancer always use great gentleness in examining the affected breast, for rough handling may cause metastases.

Is one breast larger than the other?

Is a definite tumor present?

Is the nipple retracted?

Is there an elevation of the affected breast with a shortening of the line from mid-clavicle to nipple?

Is there any discharge from the nipple?

Is the tumor tender or painful?

Is there any attachment between the tumor and the skin, with slight dimpling at that point?

Is there any fixation of the tumor to the muscle or fascia underneath?

This is best determined by having the patient place the hand on the hip of the affected side and press downward. This makes the muscles tense, and if there is any attachment to the muscle or fascia, the tumor is fixed.

Does the mass transmit light?

Are there any enlarged lymph nodes in the adjoining axilla or above the clavicle? If so, are they hard or soft?

Is the liver enlarged?

Is there any indication of pulmonary or bony metastases?

Is the patient anemic?

Is there any apparent loss of weight?

We feel that a biopsy is very important, but have not used the punch biopsy except in late or inoperable cases of malignancy, and then only to confirm the diagnosis. In cases suspected of malignancy

nancy, it is our custom to prepare the patient for a radical amputation and have the pathologist present. We either excise the growth or remove a section of it for frozen section. When a surgeon cuts into the tumor in most instances he will know if it is malignant; cutting a carcinoma gives a sensation similar to that of cutting a potato. The pathologist gives us an opinion in a few minutes and we are governed accordingly.

Breast tumors occur chiefly in the female, but occasionally are seen in the male. They seldom occur before puberty but may be found at any age thereafter. Benign tumors are most often seen in younger women and are often painful; while malignant tumors, prior to metastases, seldom cause pain.

#### CLASSIFICATION

Benign	Fibroadenoma
	Chronic cystitic mastitis
	Cystic disease
	Lipoma
	Hypertrophy
	Gynecomastia . .
	Intracanalicular papilloma
Malignant	Sarcoma
	Carcinoma

*Fibroadenoma* is the most common tumor of the benign group, and occurs usually in young women. This tumor is most often single, but occasionally is multiple and may be bilateral. These tumors grow slowly and usually are freely movable and sharply outlined. They may be more tender and painful at menstruation. They are not associated with enlarged lymph nodes in the axilla. Biopsy should be by complete excision.

*Chronic Cystic Mastitis*, or *Mazoplasia*, although this name is misleading (it has been given many others), is included with, and sometimes productive of, solid tumors. These tumors are usually bilateral. They are often painful at or near menstruation, and the pain may persist between periods. Sometimes there is a serous discharge from the nipples. The breasts usually feel lumpy and the mass or masses are not freely movable in the breast tissue. There is a sensation of induration or diffuse fibrosis with indefinite borders; and in some cases a "shottiness." The axillary nodes are often palpable and tender. This condition may be seen at any age from puberty to old age, but is most often seen in the third and fourth decades.

Chronic cystic mastitis seldom requires surgery. Occasionally we find a borderline case with a cancer complex: in such a case simple mastectomy and biopsy may be advisable, and we have at times

excised a pie-shaped section, including the affected lobule.

*Cystic tumors* are seen occasionally. They can usually be transilluminated or diagnosed by aspiration. They should be extirpated.

*Lipomas* of the breast are rare: we have seen four cases. Lipomas should, in our opinion, be removed.

*Bilateral hypertrophy* of the breast often occurs and at times may require simple amputation for cosmetic reasons.



Fig. 1. Gynecomastia in a school boy of 18.

*Gynecomastia*, a freak of nature occurring in the male, produces large breasts which sometimes secrete milk. Figure 1 is a photograph of a boy, aged 18, who was very much embarrassed by his schoolmates who teased him unmercifully. He was operated upon for cosmetic reasons.

*Carcinoma* of the breast is a big subject and all phases cannot be covered in any one paper. It has been estimated by representatives of the American Society for the Control of Cancer that there are 450,000 persons in the United States at the present time suffering with some form of malignancy. Of these 150,000 die annually,

their places being taken by an increasing number of new cases each year. In this vast army of sufferers, 45,000 have cancer of the breast. About 1 per cent of these occur in men. The age incidence is important. Breast cancer is seldom seen before the age of 25; as age advances the incidence increases to reach a peak between 40 and 60 years. The age of women in our series was 20 to 72 years. The average age of patients presenting themselves with breast cancer in this series was 48.5 years. J. L. Campbell reported the average age in white women as 49.7 and in colored women as 42.1. Cohn stated that the negro averaged 4.7 years younger than in white women: negro women mature earlier than white women. Single and non-parous married women are attacked as frequently as women who have borne children. The incidence of cancer in the family history should be noted, although heredity plays only a small part in making a diagnosis.

### THE CLINICAL STAGES OF BREAST CANCER

Pfahler

STAGE 1	STAGE 2	STAGE 3
Small, isolated, movable tumor in the breast. No palpable lymph nodes. No roentgenologic evidence of intrathoracic or skeletal metastases.	Larger tumor in the breast. Fixation of tumor to skin or pectoral muscles, with palpable axillary lymph nodes, or microscopic evidence of axillary metastases.	Tumor in the breast with axillary lymph nodes, and supraclavicular or distal metastases.

### TREATMENT

Radical operation only or Radical operation plus postoperative irradiation.	Pre-operative irradiation small series followed promptly by radical operation and postoperative irradiation.	Irradiation only or irradiation plus operation if disease can be made operable by irradiation—then postoperative irradiation.
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### PROGNOSIS

Operation only—70 per cent average alive and well in 5 yrs. Operation plus postoperative irradiation—71 per cent alive and well in 5 yrs.	Operation only—28 per cent alive and well in 5 yrs. Preoperative irradiation, operation plus postoperative irradiation—57 per cent alive and well in 5 yrs.	Probably not more than 5 per cent alive and well in 5 yrs. Prolongation of life and relief of pain by irradiation.
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This discussion will be confined mainly to the treatment of breast cancer. At the Sheffield Cancer Clinic in Atlanta, we have accepted Pfahler's table, outlining the three clinical stages of cancer of the breast, and try to adhere to the treatment as outlined in his published article. Approximately 10 per cent of all breast cancers will

fall into stage 1, and 80 per cent in stage 2. Seventy per cent of stage 1 should be living five years following surgery alone. Twenty to 23 per cent of stage 2 treated with surgery alone should be living after five years, but if postoperative irradiation is added to these cases the number of five year survivals will be slightly increased.

In a series of 110 clinic cases with cancer of the breast, 25 per cent died in the first year; 47 per cent were dead at the end of three years and 56 per cent in four years; and 73 per cent in five years. The accompanying charts show that in the private series there were

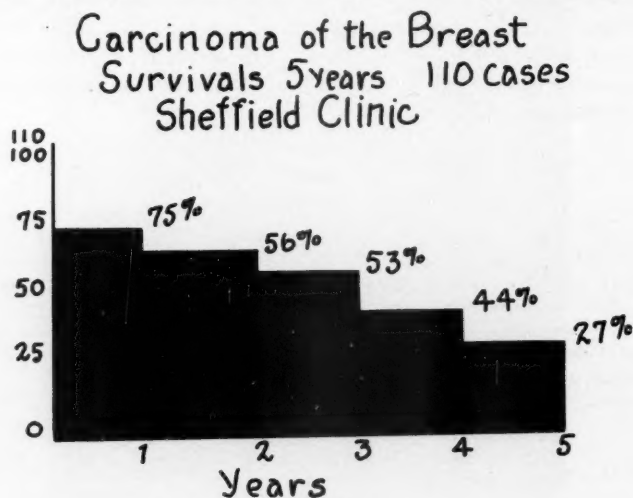


Fig. 2.

55 per cent who survived at the end of five years, while in the clinic group there were only 27 per cent living after five years. Evidently in the clinic group the carcinomas were more advanced and also the clinic patients were operated upon by a number of surgeons.

There has been little advancement in the surgical treatment of cancer of the breast in the past forty years, or since Halsted advocated the radical operation, though there have been many modifications of his original procedure.

During the latter years of the life of John B. Murphy, of Chicago, the senior author had the pleasure of spending a week annually at his surgical clinics. Those of you who knew him or attended his clinics will agree that he was a great clinician and teacher. It was while attending his clinics in March, 1915, that he met the late Dr. W. L. Rodman, of Philadelphia (who was President of the American Medical Association at that time) and heard his famous lecture on radical breast amputation. While Halsted was

the first one to advocate radical breast amputation, Rodman improved Halsted's technic by first dissecting the axilla: in this way he removed the lymphatics before handling the cancer and controlled the blood supply at its source, thereby simplifying and shortening the operation. Dr. Rodman, at the invitation of Dr. Murphy, lectured to the assembled visiting surgeons and students who filled the old amphitheater at Mercy Hospital. Then Dr. Murphy proceeded to operate according to Dr. Rodman's technic. Dr. Rod-

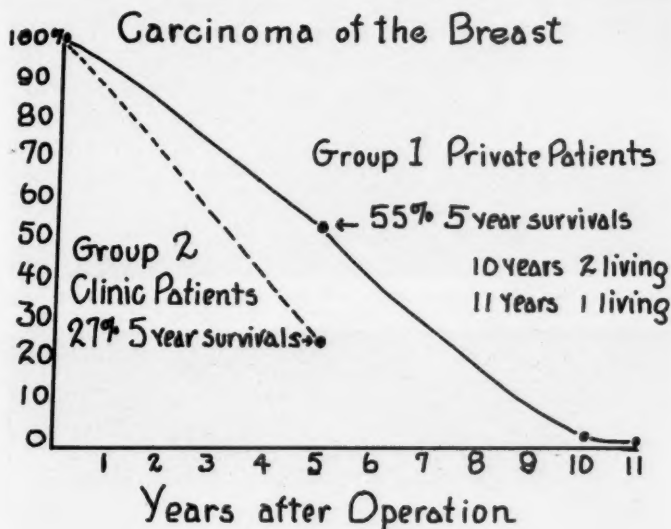


Fig. 3.

man's lecture and Dr. Murphy's remarks were published in "Murphy's Clinics" which the senior author still has and prizes very highly. We still use and teach Rodman's technic with a slight modification of the incision to keep the scar out of the axilla.

It is well known that cancer of the breast is more malignant in young women: usually the younger the victim the shorter time she will live after the operation. Cancer of the breast grows more rapidly during pregnancy and lactation. We have however one patient who is living and well eleven years after operation for cancer of the breast during lactation.

It has been shown that the ovarian hormones stimulate the production or growth of cancer of the breast in animals which have any susceptibility. In recent years when we have diagnosed cancer of the breast in a woman still menstruating, we have practiced sterilization by irradiation. It is too early to tell definitely the results in these cases.

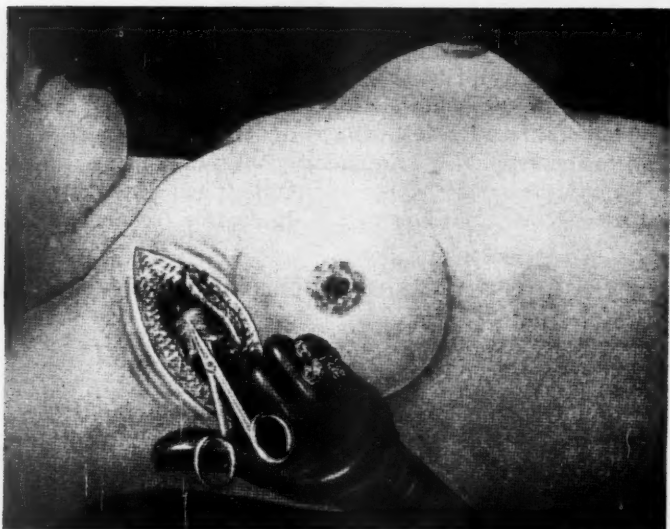


Fig. 4. Division of pectoralis minor at its insertion (Rodman, "Diseases of the Breast").

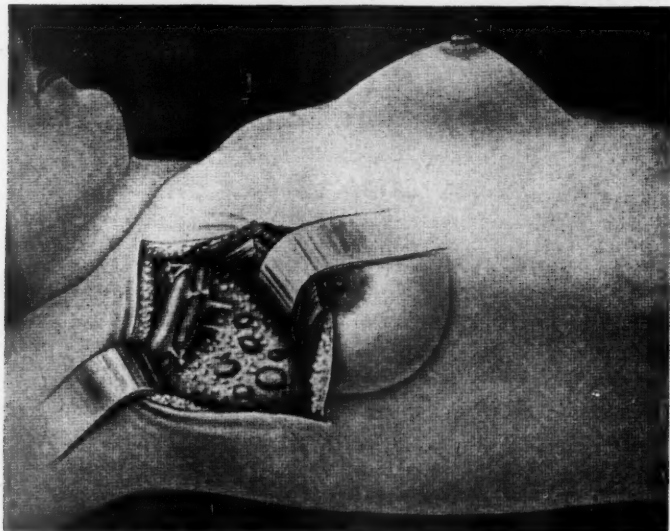


Fig. 5. Axilla freely exposed and vessels divided at their origin. The small vessels to this area are tied and cut close to the axillary vessels (Rodman, "Diseases of the Breast").

Fortunately there has been, in recent years, a marked improvement in the irradiation treatment of breast cancer. This has been due to the introduction of high and supervoltage x-ray equipment and also to the use of Coutard's technic of divided doses, rather

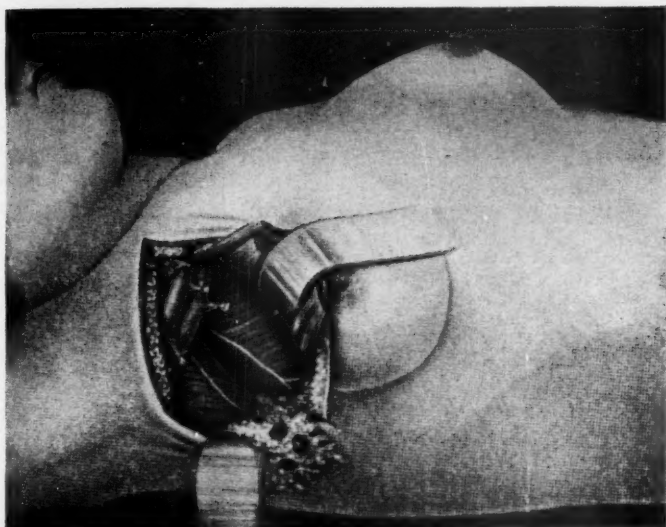


Fig. 6. Axillary dissection completed. Fascia, fat and enlarged glands *en masse* shown at base of axilla (Rodman, "Diseases of the Breast").

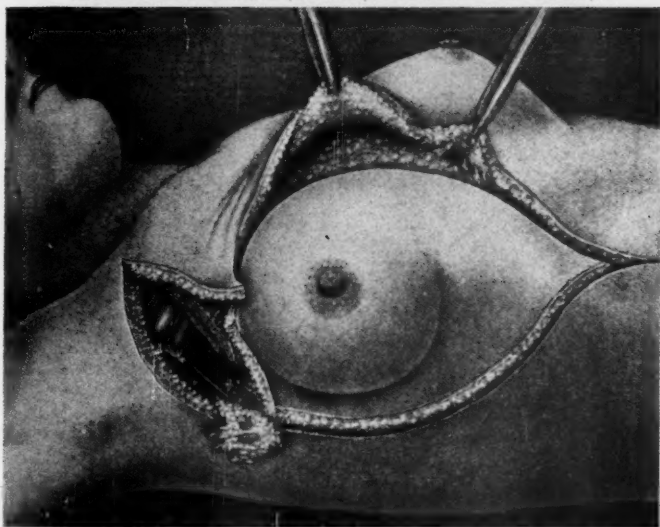


Fig. 7. Second skin incision encircling the breast and extending well downward on the chest, to include as much as possible of the lymphatics running downward to the abdomen. Observe the extensive undermining anteriorly (Rodman, "Diseases of the Breast").

than massive doses which often produced radiation sickness with nausea and prostration too great for many patients to stand. The divided doses make it possible to give greater and more effective doses, with better results. Undoubtedly the best results are now

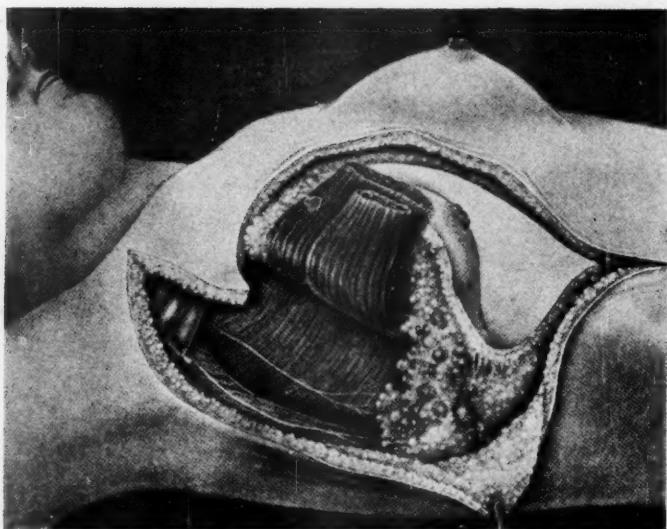


Fig. 8. Undermining inferiorly. Muscles, breast and axillary mass being reflected prior to removal (Rodman, "Diseases of the Breast").

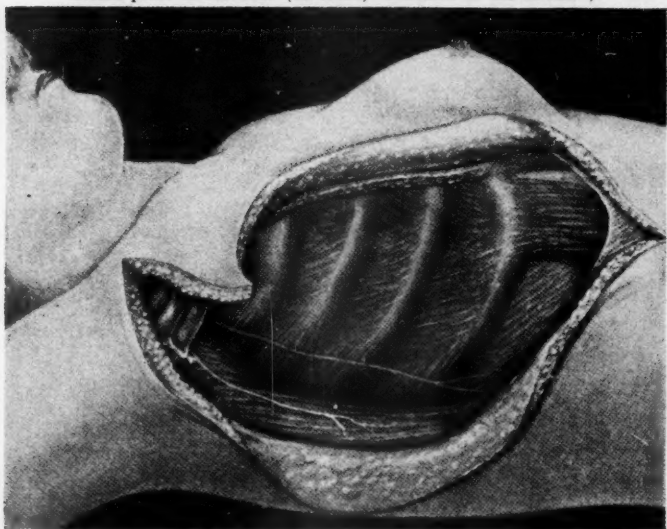


Fig. 9. Appearance of the wound after removal of the breast, muscles and axillary mass of glands and fat (Rodman, "Diseases of the Breast").

obtained by a combination of x-ray and surgery in the operable cases, and in the inoperable cases by the palliative use of x-ray alone.

At the Sheffield Clinic in Atlanta, we are using x-ray irradiation more and more as the only treatment for advanced cases of carcinoma of the breast.

Some cases, classed at first as inoperable, after a thorough series of x-ray irradiation, become operable and should have the benefit of surgery to be followed in a few weeks by more x-ray. We have operated upon some patients who had had very heavy irradiation and had been told that they were cured but, after radical surgery, both the original growth and the axillary lymph nodes were found to contain viable cancer cells. We operated upon a patient who clinically had carcinoma of the breast. She was given heavy irradiation and then several weeks later had a radical operation and the



Fig. 10. Photo of postoperative radical breast showing incision kept out of axilla and normal use of arm.

breast failed to show any viable cancer cells. Then we wondered if she had had radical surgery unnecessarily, but one year later she developed intestinal obstruction and at operation was found to have general carcinomatosis of the abdominal cavity.

We should not overlook the fact that a few patients after heavy irradiation to the breast area develop a very troublesome pulmonary fibrosis. Adair reported 8 per cent in his series. We have also had some difficulty with wounds healing in a few cases following heavy x-ray, and lymphedema of the arm in some cases is worse on account of slow healing following x-ray irradiation. We know that one cannot compromise with cancer and that we must be radical in its treatment, but when we have a patient who is so miserable with a painful, swollen, helpless arm, or a troublesome fibrosis of the lung, we wonder if, after all, it is worthwhile saving them from an early death from cancer.

### Adair of the Memorial Hospital in New York reports

Surgery alone in cancer of the breast without metastases, 65 to 70 per cent five year cures. When the cancer involves the breast together with the axillary nodes 15 to 20 per cent five year cures. When irradiation is added to surgery the percentage is raised two or three points in both instances.

Adair also reports 36.5 five year cures in a series of "*operable cases*" treated with irradiation alone, which compares favorably with the operative results which average 32 to 30 per cent in five years; and he reports 40.6 per cent five year cures by the combination of surgery and x-ray. He says further

It has also been proven that external irradiation given by high voltage x-ray and radium packs has capacity to entirely sterilize mammary cancer in about one case out of four with the present technique as we have used it, it has sterilized axillary disease in only one in ten cases. The indications are that we will probably next turn our attention to irradiation of only those cases in which there is axillary involvement.

### Gatch states that

Radical operation combined with irradiation or alone, will in nearly all cases rid the patient of the horror of the local growth. Even if treatment produced no permanent cure at all, it would still seem to be a great blessing. The results of treating breast cancer are as good as those obtained by treating cancer of the cervix, and infinitely better than those obtained by treating cancer of the stomach.

No combination of treatments can compensate for delay in diagnosis and prompt treatment.

Lazarus and Barlow, in an analysis of 651 untreated cases, found that 12 per cent survived five years. It is, therefore, apparent that only the per cent of five year survivals over and above 12 per cent can be attributed to treatment.

### Graham sizes up the problem in two paragraphs:

Any surgeon can cure a cancer of the breast when the cancer is confined to the breast, the only requirement being to remove it and keep out of it while doing so. No surgeon can cure a cancer of the breast when it has spread beyond the tissues he can remove.

Irradiation which cannot be relied upon to keep the cancer confined to the breast and which cannot be relied upon to prevent its spread cannot be considered efficient or adequate from the standpoint of cure. The catastrophe would be to allow an early cancer to become advanced, a curable cancer to become incurable.

### Hertzler says of irradiation:

That life can be prolonged by these measures is true beyond question. The ultimate goal, a matter too often overlooked, is not to prolong life indefinitely, but to provide escape from it pleasantly.

It is our opinion that all patients should be given treatment regardless of the stage of the disease, if there is any possibility of prolonging life or relieving pain.

## CONCLUSIONS

1. Radical operation to be followed by irradiation is indicated in all cases of breast cancer without axillary involvement.
2. Radical operation with a limited amount of preoperative irradiation and heavy postoperative irradiation is indicated in breast cancer with axillary involvement, provided there are no distant metastases.
3. In advanced breast cancer with distant metastases, palliative irradiation alone is indicated.
4. We believe that sterilization of younger women by irradiation is a logical procedure.

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## SURGERY IN DISEASES OF THE LUNGS AND PLEURA

ADRIAN LAMBERT, M. D.

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**S**URGERY of the chest in the past few years has made rapid strides largely because of advances in anesthesia. The hazard of operating on an open chest in which there are no adhesions with subsequent physiologic changes in respiration and circulation has been eliminated by the use of intratracheal method of administration. This constitutes a closed system whereby the gas inhaled by a patient is completely controlled, and where the lungs are made to expand in spite of atmospheric pressure in the chest. Because of this feature operations for extirpation of the lung or portion of it no longer carry the tremendous risk.

The feasibility of open operation in the chest now depends on the extent and nature of the disease rather than the patient's ability to stand a thoracotomy with circulatory and respiratory embarrassment.

With this closed system of anesthesia it is possible to control the secretions that come from the diseased portion of lung. With an intratracheal catheter, the secretions are sucked out without discontinuance of the anesthesia; thus drowning of the contralateral lung is avoided in moist cases of pulmonary suppuration or bronchopleural fistula.

At the Chest Service at Bellevue we have adopted the use of cyclopropane, having leaned away from ether because of the tendency to increased secretions, because of the rapid recovery from cyclopropane, with the patient conscious on leaving the operating table, and because of the high oxygen concentration—80 per cent—that can be administered at the same time as the anesthetic. This is an important factor in debilitated patients with chest disease, associated as it so often is with cardiac embarrassment. A second factor that has been of aid to chest surgery has been a more accurate estimation of a patient through studies of pulmonary function and reserve and cardiac function. With recent advances in the study of lung function we have gradually given up the one factor of vital capacity as an accurate index of a man's ability to withstand operation. More important is the evaluation of the degree of emphysema as calculated by percentage ratio of the residual air to total capacity; of cardiac function, including blood pressure, pulse, circulation time, venous pressure before and after exercise, and function of the same after 1,500 c.c. infusion, the oxygen saturation of arterial blood before and after exercise. Needless to say these cannot be done on those cases of suppuration where the indication is for immediate drainage, but rather refers to those opera-

tions which by the nature of the disease may allow of further study, such as cases for thoracoplasty or lobectomy. Dyspnea is evaluated and by deductions as to the type present one can predict the prognosis for a patient. A classical example of this is a thoracoplasty that is performed on a patient who before operation is dyspneic, because of return of unoxygenated blood to the heart, who after operation recovers from dyspnea, as the unoxygenated blood is shunted to aerated lung.

With the risk of an operation thus minimized, surgery of the chest does not present the hazard that has in the past been attributed to it. In considering the various diseases one should bear this in mind, as a cure can be offered a patient now, whereas previously a prolonged illness from a chronic disease was the only alternative.

#### LUNG ABSCESS

With improvement in technic and with experience of several years the treatment of lung abscess has gradually changed. At first, operation for drainage was performed at the earliest possible time—when the disease process constituted mainly a diffuse suppurative pneumonitis associated with a small area of breakdown. The effect of this treatment resulted in a 70 per cent mortality, largely due to spread, secondary to the inadequate drainage of the small abscess cavity in the presence of diffuse overwhelming pneumonitis. Because of the disastrous results of this therapy a time interval of months on postural drainage was adopted before operation, in an attempt to allow the pneumonic process to subside and thus avoid spread. The high percentage of chronic lung abscess that ensued again stimulated earlier operation, this time an interval of approximately six weeks being considered the optimum time for subsidence of pneumonitis and for the avoidance of chronic changes in the lung tissue.

Today it is felt that acute lung abscess should be operated on early, and that decision as to the time to operate should be based on the relation between the degree of pneumonitis and extent of abscess, rather than on the duration of the process. Drainage of a small cavity with large area of surrounding pneumonitis should be delayed, whereas drainage of a large cavity with minimal peripheral reaction should be performed early.

If drained early a large abscess will respond favorably. The longer the process is allowed to remain, the more chronic becomes the wall of the abscess, so that finally when the abscess is opened and drained, a stiff-walled cavity remains. The chronic lung abscess thus formed with its frequent complications of hemorrhage, spread, embolus and the complicated operative procedures of muscle im-

plant for persistent fistula and lobectomy, is sufficient to impress the importance of early operation.

In considering lung abscess differentiation is made of two types. First, the acute abscess present in previously uninvolved lung, and second, the acute abscess present in a lung already involved in a suppurative process, that is superimposed on a previous bronchiectasis or chronic lung abscess. The former responds well to drainage, the cavity is soft-walled and heals rapidly with a minimal amount of lung destruction. The second will respond well to drainage, in that the patient recovers from the acute effects of toxicity from the abscess but, as the surrounding lung tissue is indurated and fibrotic, healing is slow; and for cure the patient will usually have to come to lobectomy. Drainage should be the first procedure, if the patient is extremely ill, and if the sputum is profuse.

At operation for acute abscess the main considerations are the site of the abscess and the presence or absence of pleural adhesions. The site of a lung abscess is notably difficult to determine by physical signs so that we usually rely on an anteroposterior and lateral x-ray film of the chest to locate the abscess. Once this is determined, a section of rib is removed subperiosteally over the abscess. With a knife the bed of rib and chest wall is incised carefully down to the pleura and the presence or absence of adhesions is noted. If there are adhesions between visceral and parietal pleurae the abscess may be safely opened through the adhesions. If there are no adhesions, then a two-stage operation is immediately decided upon; packing is placed next the rib bed that has been exposed, and the patient's wound closed. At a later date, about four to twelve days, the patient is reoperated on. A soft tube is placed in the abscess with loose gauze packing if the cavity is large. Packing is subsequently removed, and the tube left in place. Then as the abscess walls close down, the tube can be replaced with a smaller one, and shortened until it is finally removed.

Preoperatively it is customary to keep patients on postural drainage, the amount and character of the sputum and weekly x-rays being followed as important indices of the nature and type of infection present. The use of pneumothorax in the treatment of lung abscess is discouraged because of the danger of empyema. For a similar reason needling of an abscess blindly is strongly advised against.

#### BRONCHIECTASIS

Bronchiectasis is a progressive disease characterized by destructive changes in the walls of the bronchi which have resulted in dilatation and suppuration. The process is irreversible. Once dilated these diseased bronchi never regain their former state, and will forever be a potential source of infection. Patients with this dis-

ease notably are free of symptoms during the dry summer months but during the colder time of the year tend to have exacerbations of their disease. These range from an increase of sputum to frank attacks of recurrent pneumonia. Because of the nature of the pathology in this disease the only cure is surgery with extirpation of the diseased portion of lung.

In considering lobectomy for a patient with bronchiectasis several points are important. After establishment of a definite diagnosis by lipiodol studies and bronchograms it is important to render the patient as sputum free as possible before operation. This is done in order to minimize the risk of spread at time of operation and to improve the patient's condition by reducing the infection as much as possible. Measures to accomplish this include postural drainage three times a day, by placing the patient in as favorable a position for adequate drainage of the diseased bronchi as possible; bronchoscopying a patient with aspiration of purulent secretions, again to effect better drainage of bronchi, and clearing up any disease of paranasal sinuses that may be present, in view of the tendency for secretions to drop down the trachea and irritate the bronchi. General improvement of patient with high vitamin-high caloric diet, ultraviolet light, etc., are also important in building up the patient as for any operation.

One stage lobectomy is desirable for bronchiectasis and is indicated except in cases with profuse, foul, highly infected type of sputum. In these it is safer to employ the two stage procedure—performing lobectomy after adhesions in the pleural cavity have been produced to minimize the extent of infection.

The residual space at the site of the extirpated lobe is gradually obliterated by rise of the diaphragm, mediastinal shift and expansion of the remaining lobe. To accelerate the action of these forces tending to reduce the size of the pleural space, the chest is sewed tight, and suction is applied through a small intercostal stab wound.

Should empyema supervene it is a localized affair and may require open drainage with removal of a portion of rib. Since the introduction of the use of sulfanilamide locally into these spaces at time of extirpation the tendency is for the infection to be minimal. Although contamination occurs at the time of operation infection may not develop at all. Lobectomy for bronchiectasis of the upper lobe is followed by a similar course of events, the lower lobe reexpanding sufficiently to fill completely the thoracic cavity.

In disease in which there is bilateral bronchiectasis involving two lobes, bilateral lobectomy is possible, the most diseased lobe being the first one extirpated. In such cases the advantages of closed intratracheal anesthesia and suction at the time of operation are obviously important. If disease has involved one entire lung (all

lobes on one side) pneumonectomy or subtotal pneumonectomy with a residual cuff of pulmonary tissue left to close the stump of the hilum should be considered. Following this procedure it may be necessary to do a thoracoplasty in order to obliterate the dead space. This, however, is often not necessary as the space fills up with fluid which becomes slowly organized.

And so to summarize bronchiectasis: It is a disease with which a patient may go along for ten or fifteen years with possibly minor exacerbations of sepsis until he has a severe episode. The time for operation, however, is during the period when he is well, when he has no sputum, is symptom free, and before he has developed severe sepsis, profuse sputum and bronchopneumonia.

#### CARCINOMA OF THE LUNG

The problem confronting the clinician in cases of carcinoma of the lung is essentially one of early diagnosis. So frequently are the first symptoms of this disease referable to metastasis rather than to the local lesion itself, that often it is impossible to make the diagnosis, unless the growth is picked up on routine x-ray. With improvement in x-ray interpretation, however, it is possible to diagnose cases earlier. What as clinicians we must constantly bear in mind is the possibility that carcinoma may be present. It is the obligation of the practitioner to explain intractable cough. If it is remembered that about 10 per cent of all lung abscess is associated with carcinoma of the bronchus, that frequently the only sign may be a history of bleeding, and that pain usually represents the more advanced stages of the disease, with involvement of the pleura secondary to the suppuration behind the growth, then carcinoma of the bronchus will be picked up earlier, and chances of surgery benefiting the patient correspondingly greater. The surgical treatment of carcinoma again includes removal of the growth. If this is well within one lobe, then lobectomy is indicated. If, as is more usual, the growth involves larger branches of the bronchus, pneumonectomy is indicated. The relative ease of this procedure depends on the condition of the hilum. If the root of the lung is free and there is no involvement with inflammatory reaction, the vessels and bronchus can be dissected out with a minimum of danger and the lung removed. If, however, the tumor has progressed to occlude the bronchus so that suppuration has developed with involvement of the pleura and with enlargement of hilar nodes in inflammatory reaction, the dissection is difficult, the operation more hazardous, and chances of a cure less. The presence at time of operation of metastatic nodes extending into the mediastinum and up along the trachea toward the aorta is sufficient to consider the growth inoperable. The extent of metastasis, however, may be impossible to predicate without exploratory operation. Thus, carci-

noma of the lung should be explored, unless the presence of metastases has been established.

Reports concerning the effect of radiation on carcinoma of the lung are somewhat conflicting. Cases have been reported of arrest of malignancy with irradiation, but this has not been our experience. Extirpation of the lung (pneumonectomy) is the only cure of this disease, and the earlier the diagnosis can be made the greater the chance of cure. Radiation should be given to those cases considered inoperable either at time of operation or because of metastases. This will often alleviate pain, it may cause sufficient shrinkage of the growth to allow drainage of the suppuration distal to the occluded bronchus with subsequent generalized improvement of the patient. In cases where the carcinoma has invaded the chest wall radon seeds will frequently control the pain. If these fail, alcohol injection of intercostal nerves may have to be resorted to, or even chordotomy.

In establishing the diagnosis, bronchoscopy should be performed, a piece of the tumor obtained for biopsy. Lipiodol studies will outline the bronchial tree and reveal a constriction of the bronchus or a mass with failure of the lipiodol to penetrate that portion of the lung. Presence of tumor cells in the sputum are of assistance in making a diagnosis, although we have not found this as helpful as has been reported by some observers (Edwards). Characteristic x-rays are regarded as sufficient evidence to explore a chest, even in the absence of positive biopsy.

Following removal of the lung the chest is closed tight. Local application of sulfanilamide crystals controls the infection. In these no drain is inserted. It occasionally becomes necessary to tap the chest because of pressure from the hydrothorax that accumulates postoperatively. What eventually happens to this space is not completely understood. As in lobectomy the diaphragm rises, the mediastinum comes over and the chest wall contracts, but left is a residual space, which fills with fluid that may or may not organize.

#### EMPHYEMA

Accompanying any of the conditions so far discussed may be the presence of pus in the pleural cavity. Empyema may be secondary to suppurative conditions in the lung or it may be primary following a pneumonia. Probably of all suppurative conditions in the chest it is the one most frequently encountered.

The two classic types of acute empyema with which you are all familiar are the so-called thin and thick types, as typified by streptococcus and pneumococcus types respectively. The surgical treatment of this disease is still based on a few important considerations. Since the War in 1918 it has been recognized that cases should not

be drained in the presence of underlying pneumonitis. This is especially so of the streptococcus type, in which the empyema is prone to form before the pneumonia beneath has completely resolved. Pneumococcus empyema, on the other hand, develops shortly after subsidence of pneumonia, the typical secondary temperature rise being a well recognized sign of its development. Drainage should not be instituted at once, until the fluid has had time to thicken. Rather the pleural pocket is kept as small as possible with repeated aspirations until the fluid becomes more purulent and adhesions begin to form. Then when open drainage is instituted, the drained space is a small pocket. The presence of the adhesions prevents a complete empyema from apex to base and the lung reexpands in a short time to obliterate the space.

When the empyema is secondary to a suppurative condition in the lung, it is necessary to drain it and then treat the underlying cause. In cases of massive, anaerobic, so-called putrid empyema, immediate drainage is indicated to relieve the patient of the overwhelming effects of his infection. Open drainage is considered preferable to closed drainage in these cases to minimize the chance of chest wall phlegmon at the site of closed drainage tube.

Since the institution of sulfanilamide derivatives in the treatment of pneumonia during the past year there is no doubt but that the incidence of empyema has decreased correspondingly. The reason for this is probably that the pneumonia is aborted before it has progressed to the point when empyema usually develops.

The results of the effect of intraoral administration of these drugs on the sterilizing of empyema have been contradictory. Occasionally an empyema will clear up but usually this does not obtain. The local application of these drugs in empyema is being employed by us. The number of cases is not large enough to report but results are sufficiently encouraging to continue their use.

As one of the most important causes of chronic empyema is inadequate drainage with pocketing above or below the site of drainage it is important to place the incision so as to prevent the blocking of the tube with rise of the diaphragm and shrinkage of the cavity.

In the treatment of chronic empyema x-rays of the chest, intelligent probing of the sinus if it has been previously opened, and lipiodol injections will give information as to size, shape, and type of cavity. Cultures will determine the nature of the infection; sputum examination and section of sinus tract may establish a tuberculous background. The presence of a bronchopleural fistula should be ascertained with lipiodol, as this is another cause of chronic empyema. With sufficient understanding of the nature of the patient's empyema treatment should include establishment of ade-

quate drainage with removal of any foreign bodies that may be present, such as calcified pleura, osteomyelitis of the rib, tube, sponge, etc. Frequently after adequate drainage has been effected and suction applied the empyema will close. If not and a cavity remains, extrapleural thoracoplasty may be necessary.

#### TUBERCULOSIS OF THE PLEURA

Tuberculous infections of the pleura begin as a serofibrinous effusion and then progress to the frankly purulent stage. This transition may occur in a short time or over a long period. Diagnosis in the early phase may have to be made with guinea pig inoculations. In the later stage the organisms may be easily recognized on smear. Usually the disease is secondary to pulmonary tuberculosis. It may occur as a simple pleurisy with effusion. It follows such procedures as pneumothorax, or thoracoscopy with division of pleural adhesions, or it may develop following the rupture of a tuberculous cavity or subpleural caseous nodule into the pleura with ensuing generalized infection of the space.

One of the peculiar properties of tuberculosis of the pleura is its ability to heal when two surfaces of pleura become approximated. Following this, adhesions form, and the pleural space is obliterated. Therefore, once a purulent tuberculous empyema exists, treatment should be directed towards approximating the two layers of pleura. This should be done first by repeated aspirations of the pleural fluid in an attempt to bring the lung out and approximate visceral to parietal pleura. If this is unsuccessful because of rigid, visceral pleura, or if reexpansion of the lung is inadvisable, then it will be necessary to collapse the chest wall to bring parietal pleura down to visceral pleura by extrapleural thoracoplasty. Cases of tuberculous empyema should not be drained unless they have become secondarily infected or have developed a bronchopleural fistula. With a fistula it is necessary to prevent flooding of the contralateral lung, although it may be feasible to tap them repeatedly if they can be kept dry and thus avoid a spread. With secondary infections such as staphylococcus or streptococcus, one should first try irrigating the cavity with antiseptic solutions preferably gentian violet, or azochloramine. With failure of this treatment and with development of sepsis it will be necessary to drain, in spite of the tuberculous nature of the disease. The use of oleothorax has been given up because of secondary changes in the pleura and lungs.

Failure to treat noncomplicated purulent tuberculous empyema as described above constitutes a risk of a bronchopleural fistula to the patient, a risk which is not justified. The development of purulent tuberculous empyema in the course of pneumothorax should indicate the discontinuance of pneumothorax, the reexpansion of the

lung with obliteration of empyema space and subsequent thoracoplasty, should the pulmonary disease warrant it.

#### TUBERCULOSIS OF THE LUNG

For the sake of convenience I have divided the tuberculous from nontuberculous conditions of the chest as their treatment is so different.

On the Chest Service at Bellevue Hospital the use of pneumothorax is still being employed for those patients with tuberculosis that do not respond to bed rest. Although this is fundamentally a surgical treatment it has been relegated to the medical men to perform, so that at present on surgery we see those cases only on whom pneumothorax has been unsuccessfully attempted, or in which collapse has been inadequate because of adhesions.

Important points that should be considered before going ahead with surgical collapse for patients with pulmonary tuberculosis include the following:

The patient should be in good general condition. By that is implied that the patient should be built up as for any operation, with high vitamin-high caloric diet, with adequate water balance so that he is not dehydrated, with transfusion if he is anemic, iron and other adjuvants being employed. Preferably the patient should be gaining weight or holding his own. If he is losing weight it should be determined that the loss is due to the presence of the disease that is to be affected by the local surgical collapse. If his weight loss is due to intestinal tuberculosis then thoracoplasty for cure of pulmonary disease probably will not benefit him. In estimating this one should consider the patient's clinical picture and if the presenting symptoms seem to be referable to the gastrointestinal tract, surgical collapse of the chest is not indicated; whereas if it is on basis of pulmonary disease then operation will be of benefit.

In addition to general condition the cardiac and pulmonary reserve of the patients should be estimated. As has already been brought out, this can be done accurately through use of the various tests employed to evaluate the degree of emphysema and fibrosis, cardiac function before and after exercise, etc. As already mentioned, dyspnea in a patient is not necessarily a contraindication to thoracoplasty as these patients may improve their lung function following operation.

This also is true with large cavities where oxygen exchange is small and unaerated blood is shunted into the aerated portion of lung. If on the other hand a dyspneic patient has marked emphysema and fibrosis, and if to collapse the cavity it is necessary to collapse a portion of the patient's good lung, then thoracoplasty is a questionable procedure for complete rehabilitation.

The most important consideration in these patients is the type of disease present in the lung. The advantage that will be gained by thoracoplasty will be due to permanent collapse of that portion of the lung over which the ribs are removed. The cases that have unilateral cavitation which are moderately or far advanced in type, productive in character, without recent exacerbation of tuberculosis respond most favorably to thoracoplasty.

In bilateral disease it may be feasible to do a thoracoplasty on one side while pneumothorax will control the lesion on the opposite side. Provided the other side is stabilized, permanent collapse may be effected to render the sputum negative. In giant cavities results of thoracoplasty vary. Usually it is difficult to close completely those cavities with thoracoplasty although sufficiently large number have been done to warrant the attempt. Criteria of success of the procedure is the rendering of the sputum negative. This should be judged both by repeated concentrates and cultures. Cases of large cavities with profuse sputum will be materially benefited following thoracoplasty if the sputum can be diminished. Repeated postoperative bronchoscopies will help patients empty their bronchi and allow the cavity that is being collapsed to drain. Occasionally the bronchus going to such cavities will become kinked with backing up of secretions and secondary systemic reaction. In such cases bronchoscopy is essential to tide the patient over the acute stage. On the Chest Service at Bellevue all bronchoscopic treatments are done by the chest surgeons themselves.

It is impossible to predict the presence of adhesions even in cases of advanced disease of the lung. Therefore an attempt is made to give pneumothorax before considering extrapleural thoracoplasty, as occasionally a good collapse is obtained in these advanced lesions. If pneumothorax, however, is unsuccessful in collapsing the cavity and rendering the sputum negative, then it should be discontinued and after the lung has reexpanded, thoracoplasty should be performed.

The age of a patient being considered for thoracoplasty is important but not all important. We are doing more thoracoplasties on people over 45 with as low a mortality as in the younger age groups. In performing such operations shorter segments of ribs are removed at one time, and more operations performed than are used in younger patients.

In a recent survey by the Board of Health of Municipal Lodging House dwellers, 5 per cent of all members were found to have a positive sputum. In an attempt to eradicate the spread of the disease, these patients have all been referred to the Chest Service at Bellevue for treatment. Most of these men are over 45 years of age, have no home, and comprise a transient population that comes

and goes in our country. Facilities for rest are not available, their disease is usually well stabilized, but they have an open lesion and as such comprise a public menace. With this in view we have considered thoracoplasty on several of these men. Pneumothorax is not feasible as facilities for continuing such do not follow them in their wanderings over the countryside. Hence it is felt that if this group can be permanently rendered sputum negative thoracoplasty is justified. With our low mortality this has been performed with success and it is felt that this is an important step in the control of this disease.

In addition to low respiratory function, reserve, and myocardial degeneration, a fresh active lesion on the other side or in other organs is a contraindication for thoracoplasty. Amyloid disease in itself is not a contraindication unless there is additional suppurative focus responsible for it, which thoracoplasty will not obliterate. Tuberculous ulceration of the bronchus, like tuberculous ulceration of the larynx, is felt to be improved as the source of infection in the lung is healed and hence neither is regarded as a contraindication. When ulceration involves the trachea as well as the bronchi, however, it is felt best to withhold operation until this subsides.

Other surgical procedures are employed occasionally at Bellevue but with less enthusiasm than in other clinics. Phrenic exeresis has been discarded. Indications for phrenic crush include first, pulmonary hemorrhage that does not respond to routine measures; second, thin walled apical cavities surrounded by a small amount of fibrous tissue, that may or may not have a contralateral lesion. We do not use the procedure as routine prior to thoracoplasty because after thoracoplasty the postoperative course is stormier, the cough is less effective, the chances of spread to the uninvolved lung are correspondingly greater. It is still impossible to foretell in any doubtful case what the result will be, and we have seen it do harm in reducing pulmonary reserve, producing gastric distress, etc.

Intrapleural pneumonolysis with division of adhesions is useful in cases of strand-like adhesions that are responsible for failure of collapse. Tuberculous empyema may follow if lung tissue is divided in the adhesion so that care must be taken to transilluminate the adhesion before dividing it.

It is impossible to dogmatize about the efficacy of so recent a procedure as extrapleural pneumothorax. Results differ. Dolley and Jones report 30 per cent tuberculous infections in extrapleural space following the operation. Others vary. There is no doubt that the operation is easy to perform, but the complications of hemorrhage and infection are so frequent as to make it prohibitive. We use it only as a preliminary to thoracoplasty in those cases with adherent pleura who have fulminating unilateral disease making thoracoplasty impossible.

## CONCLUSIONS

In concluding this somewhat cursory summary of a few of the salient features of surgery in diseases of the lungs and pleura, I should like to emphasize its importance to you gentlemen, as general practitioners. You are all seeing cases that fall into these groups that I have been discussing. Whereas before our hands were necessarily tied in dealing with some of these difficult problems for lack of a means of therapy that was feasible, we now have a means at our command for taking care of these patients and getting them well. A case of bronchiectasis can be treated medically but it can never be cured without lobectomy. The time to operate on this disease is when the patient is well, not when he is sick. Cancer of the lung depends on early diagnosis. The fate of these patients lies in the hands of the first man that sees them. After that it may be too late. If we become cancer conscious in cases of intractable, unexplained cough, of hemorrhage or with early x-ray signs in the chest more cases of this disease will be operable and chances for cure greater. Treatment of lung abscess is early drainage; but equally as important as the time factor, is the type of abscess that one is dealing with. These cases should be followed by surgeons and medical doctors together as soon as the diagnosis is suspected so that the optimum time for operation will not be missed.

Again in the treatment of tuberculosis, the more we realize the benefits that surgery can offer, the better are we going to be able to take care of our patients. If we can save a man two years' convalescence and get him back to work with a negative sputum, I think that anything we can do will be worthwhile.

## SPINAL MENINGIOMAS

A Report of 4 Cases, 3 of Which Were in Negroes

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**I**NTRADURAL, extramedullary tumors of the spinal cord comprise 65 per cent of all primary spinal cord tumors (Elsberg). Of these approximately 85 per cent are either meningiomas or neurinomas, the latter occurring a little more than half as frequently as the former. These neoplasms are of great surgical importance because they can be removed completely without damage to the spinal cord. The diagnosis can easily be made before irreversible cord changes have occurred, but all too frequently patients are completely paralyzed before reaching the neurosurgeon.

Cushing and Eisenhardt<sup>1</sup> contrasted the ratio of spinal to intracranial meningiomas in their series (1:16) with that in Elsberg's<sup>2</sup> series (1:2.5). This difference can be readily attributed to preeminence in different spheres of neurosurgery.

The rarity of intracranial meningiomas in the negro, which was emphasized by Cushing and Eisenhardt, appears to apply equally to spinal meningiomas. Inquiry at various neurosurgical clinics treating large numbers of negro patients has borne out this contention. Dr. C. C. Coleman, of Richmond, has informed me that in the last 10 years there has been no case of spinal meningioma in the negro race at the Hospital Division of the Medical College of Virginia. Dr. Francis Murphey, of Memphis, states that no spinal meningioma or neurinoma has been found in a negro in the last five year period although all neurosurgical cases in a 350 bed negro hospital were observed. On the other hand, Dr. S. R. Snodgrass, of Galveston, has recently removed a spinal meningioma in a young negro man. It is of particular interest, therefore, that in the two year series reported here, 3 of 4 spinal meningiomas occurred in negroes, 2 of whom were almost coal-black (Cases 1 and 4).

The predominance of spinal meningiomas in females in the series of Cushing and Eisenhardt (67 per cent) is reflected in the short series here (100 per cent). Although all four meningiomas in this series were located in the upper thoracic region, the incidence of meningiomas at this site is but little greater than the average per vertebra elsewhere.

The spinal as well as the cranial meningiomas are thought to originate from clusters of arachnoidal cells.<sup>3</sup> However, the spinal meningiomas are far more uniformly of the benign psammomatous type. Although they regularly invade the dura mater, they rarely penetrate it or involve bone. The invaded dura mater must be removed along with the neoplasm to establish a permanent cure.

The spinal meningiomas are moderately vascular tumors which usually receive their blood supply through the dura mater. Occasionally vessels pass directly from the spinal cord or nerve roots to the tumor. Often the vascularity in the vicinity of a spinal meningioma is considerably increased, probably as a result of free communication between the arteries and veins within the neoplasm.

#### REPORT OF CASES

CASE 1.—M. S., a colored woman, aged 43, was admitted to the Louisville City Hospital on Aug. 10, 1937, complaining of inability to walk.

HISTORY: The patient had had no difficulty using her lower extremities until October, 1936. After ten days in bed because of a respiratory infection she found that she was unable to walk although she could move both lower extremities. Difficulty in controlling the vesical and rectal sphincters developed and progressed until admission. For three months prior to admission the lower extremities had been completely paralyzed. They became very spastic with frequent severe flexor spasms. The patient suffered severe pain between the shoulders and in the epigastrium when the spasms occurred or when she coughed or sneezed.

EXAMINATION: The examination was essentially negative except for the neurologic findings referable to the trunk and lower extremities. No voluntary movement was present in either lower extremity. The tonus in the extensor and adductor muscles was greatly increased and the flexion reflexes were easily elicited by stimulation below the hips. Symmetrically hyperactive tendon reflexes were present in the lower extremities with sustained patellar and ankle clonus. The abdominal reflexes were absent and bilateral Babinski signs were present.

Sensation to pin prick, cotton, heat and cold was diminished over the lower thoracic region, but the diminution was more apparent over the abdomen and lower extremities. No sharp line of demarcation could be made. Vibratory sense and position sense were lost in the lower extremities. Bilateral compression of the jugular veins caused pain between the shoulders and in the epigastrium.

Spinal puncture was performed at the third lumbar interspace with a free flow of clear, colorless fluid. The initial pressure was 170 mm. of water. Bilateral jugular compression caused a delayed rise to 250 mm. Upon release, the pressure fell slowly to 210 mm., 40 mm. above the original level. Abdominal compression caused a prompt rise to 300 mm. with a return to 160 mm. after release. These findings were interpreted as indicating a definite partial block.

Serologic tests on blood and cerebrospinal fluid were negative. The thoracic spine appeared normal on roentgenograms.

Because of the uncertain sensory level, 1 c.c. of lipiodol was introduced by lumbar puncture. Fluoroscopic examination revealed a complete arrest of the lipiodol at the fourth thoracic vertebra when the patient was suspended vertically with her head downward.

The preoperative diagnosis was "extramedullary spinal cord tumor at the fourth thoracic vertebra."

**OPERATION:** Aug. 26, 1937, under avertin, local and supplementary gas inhalation anesthesia the laminae of the third, fourth and fifth thoracic vertebrae were removed. Large veins were encountered on the left side, entering the dura at the level of the fourth thoracic vertebra. When the dura mater was opened, it was apparent that these veins entered a reddish tumor about 1 by 1 by 2 cm. which lay to the left of the spinal cord and extended around to the anterior surface of the spinal canal. The tumor and the invaded dura mater were totally removed, silver clips being used for hemostasis. The dura mater was closed except for the excised area. The erector spinae muscles were closed with No. 2 chromic sutures and the deep fascia, superficial fascia and skin with small interrupted silk sutures.

**MICROSCOPIC EXAMINATION:** The tumor was composed of whorls of cells with round or elongated nuclei arranged in a rather scanty stroma. There was hyalinization of the centers of many of the whorls, but no calcification. **Diagnosis:** Psammomatous meningioma (fig. 1, a).

**SUBSEQUENT COURSE:** Spinal cord function began to improve during the first few days after operation. A month later the patient could sit up in bed without a back rest. Bladder control and voluntary movement in the lower extremities had returned. Sensation was much improved. However, the patient was not ambulant when discharged seven weeks after operation. Improvement continued and on April 4, 1938, a notation was made as follows: "Patient stands up without difficulty. She is able to walk clumsily without support." Improvement continued, but the patient moved away and further progress could not be checked.

**COMMENT:** The history in this case was characteristic of a slowly growing extramedullary spinal cord tumor except for the rather sudden onset. The root pain was characteristically exaggerated by coughing, sneezing or straining, by the severe flexor spasms of the lower extremities and by jugular or abdominal compression. As is not infrequent, the sensory level was indefinite although the paraplegia was complete. A small quantity of lipiodol was necessary to localize the tumor in the absence of a distinct sensory level.

The diagnosis of spinal cord tumor could have been made much earlier. The patient had been examined previously, but apparently a history of antisyphilitic treatment and a somewhat unusual personality threw the examiners off. The postoperative result was very satisfactory considering that the patient had not been ambulant for eleven months and had been completely paralyzed for three months.

**CASE 2.**—A white housewife, aged 37, was admitted to the Louisville City Hospital on May 10, 1938, complaining of pain in right upper abdomen, paralysis of the right leg and inability to control bladder.

**HISTORY:** In 1934 the patient first suffered from sharp shooting pains in the region of the right scapula and the right upper abdominal quadrant. There was increasing frequency and urgency of urination in 1935, but the patient was able to pass only small quantities of urine. At that time the legs were becoming definitely stiff. In 1936 panhysterectomy and perineorrhaphy were performed under spinal anesthesia, following which both lower

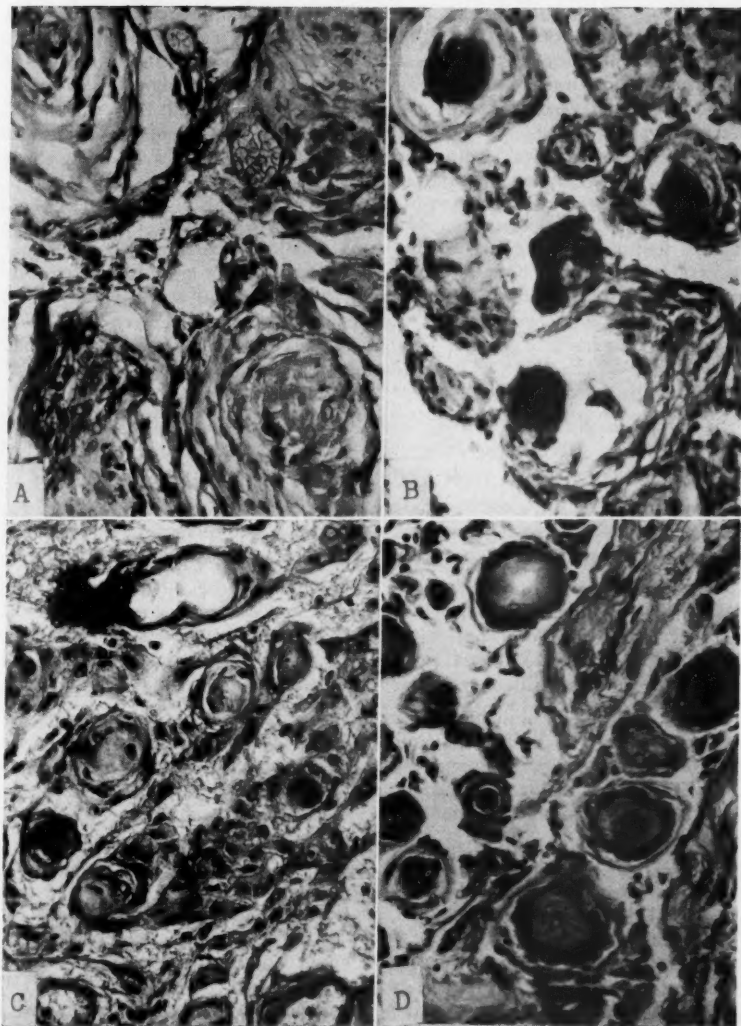


Fig. 1. Hematoxylin-eosin preparations magnified approximately 175 diameters.

A. Case 1 shows large whorls, but no calcification.

B. In Case 2 the whorls are smaller and hyalinization and calcification within the whorls of cells are common.

C. The histologic picture in Case 3 is quite like that in Case 2.

D. There are a few whorls in Case 4 which do not show concentric rings of calcification.

extremities were completely paralyzed. There was complete urinary retention and severe constipation. After three months the patient was able to walk with the aid of crutches. Improvement continued for a while, but in 1937 the symptoms again progressed, resulting in paralysis of the right leg in extension and marked weakness and extensor spasticity in the left leg. At admission she was barely able to get around by holding on to objects, and there was urinary incontinence. Coughing or sneezing caused a tearing pain about the right costal margin.

**EXAMINATION:** The urinary bladder was distended and tender. Other positive findings were limited to the trunk and lower extremities. The right lower extremity could be moved voluntarily only at the hip. All movements were possible in the left lower extremity, but there was marked increase in extensor tonus with weakness of the flexor muscles. The knee and ankle jerks were increased 3 plus on the left, 4 plus on the right with sustained ankle clonus on the right. The abdominal reflexes were absent and bilateral Babinski signs were present.

Sensation to pin prick, cotton, heat and cold was diminished below the seventh thoracic dermatome bilaterally. Vibratory sensation was lost, but sense of position was only moderately diminished in both great toes.

The patient walked only by holding to the bed or a chair. The right leg remained in rigid extension and was difficult for her to move. Compression of the jugular veins reproduced the pain at the right costal margin.

Clear, colorless fluid was obtained by puncture at the third lumbar interspace. The initial pressure of 300 mm. of water was not raised by repeated bilateral jugular compression. However, abdominal compression repeatedly caused a rapid rise to 380 mm. with a rapid fall after release to the original level. These findings indicated a complete subarachnoid block.

The cerebrospinal fluid cell count was 0, the total protein 100 mg. per cent, and the serologic studies on both blood and cerebrospinal fluid were negative. Roentgenograms revealed a narrowed interspace between the fourth and fifth thoracic vertebrae and some degree of irregular flattening of the pedicles of these two vertebrae.

Preoperative diagnosis was "extramedullary spinal cord tumor at the fourth or fifth thoracic vertebra."

**OPERATION:** On May 23, 1938, under local anesthesia, the laminae of the fourth, fifth and sixth thoracic vertebrae were removed. When the tense dura mater was incised, a reddish tumor could be seen compressing the spinal cord posteriorly from the right side opposite the fifth thoracic vertebra. Division of the fifth and sixth thoracic posterior roots was necessary in removing the mass because they were surrounded by it. The tumor, which measured 2 by 2 by 1 cm., was removed intact along with the involved dura mater. After thorough hemostasis the wound was closed without drainage.

**MICROSCOPIC EXAMINATION:** In a rather vascular stroma there were whorls of cells with round or elongated nuclei. Hyalinization and calcification were prevalent in the centers of the groups of concentrically arranged cells. Diagnosis: Psammomatous meningioma (fig. 1, b).

**SUBSEQUENT COURSE:** Following operation there was complete flaccid paraplegia. The radicular pain was completely relieved and did not recur. Sensation to pin prick was present only in the right lower extremity and

was greatly diminished there. One week later cotton could be detected on both lower extremities. Six weeks after operation there was good movement in the left lower extremity, but movement only in the right hip. Six months after operation the patient was able to void voluntarily although there were 100 c.c. of residual urine after voiding. She was able to walk by holding to a chair. Soon the patient was able to empty her bladder completely. When last seen (March 4, 1940) there was a definite, but incomplete Brown-Séquard syndrome with more pronounced motor impairment in the right lower extremity and diminished sensation to pain and temperature on the left. However, she was able to get about the house without crutches by holding on to the furniture. She did her own housework.

**COMMENT:** The increase in symptoms following spinal anesthesia may have resulted from the lumbar puncture *per se* rather than from the presence of the spinal anesthetic since this is a not infrequent complication of spinal puncture in cases of spinal cord tumor. However, the preoperative lumbar puncture caused no change in symptoms.

The increase in symptoms following operation is not an unusual occurrence. Since improvement may begin as long as a year after the occurrence of complete paraplegia, it is important to prevent pressure sores and severe bladder infection which invariably retard recovery.

In all probability the diagnosis could have been made two years or more before it was actually made. If this had been done, indubitably the operation would have been technically easier and the operative result more satisfactory.

**CASE 3.**—A colored woman, aged 29, was admitted to St. Joseph's Hospital, Lexington, Kentucky, on Aug. 26, 1938, having been referred by Dr. Fred Rankin with a diagnosis of probable spinal cord tumor.

**HISTORY:** In March, 1938, six months before admission, the patient noted that her right foot felt ice-cold at times. For the next six weeks there was a feeling of numbness and stiffness in the whole right lower extremity. In May similar paresthesias and stiffness developed in the left leg. During July the muscles of both lower extremities became very stiff, often resulting in clonic contractions. The patient had been unable to walk for four weeks prior to admission. Numbness had extended as high as the costal margins. No pain was present at any time even upon coughing or sneezing. Retention of urine began two days before admission.

The patient had suffered for one week from a peripheral paralysis of the left side of the face in 1933. This was considered irrelevant.

**EXAMINATION:** Positive findings were limited to the lower extremities and trunk. Voluntary motor function in the lower extremities was present only at the hips. There was marked hypertonus of the extensor muscles with flexion reflexes and positive Babinski signs. The tendon reflexes were maximally increased bilaterally, and sustained ankle and patellar clonus were present.

Diminution of sensation to pin prick, cotton, heat and cold was observed bilaterally below the sixth thoracic dermatome, the loss being much greater on

the right side. Vibratory sense and position sense were lost in the lower extremities. Jugular compression caused no pain.

Clear, colorless cerebrospinal fluid was obtained by puncture at the third lumbar interspace. The initial pressure was 200 mm. of water. Pressure over both jugular veins caused a slow rise to 215 mm. with a slow fall back to 200 mm. Abdominal compression caused a prompt rise to 275 mm. of water with a prompt fall to the original level. These findings indicated an almost complete subarachnoid block.

Serologic studies on blood and cerebrospinal fluid were negative. Roentgenograms showed slight irregularity and flattening of the right third thoracic pedicle.

The preoperative diagnosis was "spinal cord tumor at the third thoracic vertebra, possibly intramedullary."

**OPERATION:** On Sept. 2, 1938, under local anesthesia the laminae of the second, third and fourth thoracic vertebrae were removed. When the dura mater was opened, the spinal cord appeared prominent as if expanded by an intramedullary tumor. After the exposure was increased at the upper end of the wound, it was possible to see the margin of a reddish tumor on the left side, anterior to the spinal cord. In order to approach the neoplasm from the side without retracting the spinal cord it was necessary to sacrifice the left posterior articulation between the second and third thoracic vertebrae. After division of the left second and third thoracic posterior roots it was possible to detach two dentate ligaments from the dura and rotate the spinal cord to the right with very little pain. The tumor measured 2 by 1.5 by 1 cm. and extended from the point of exit of the left second thoracic nerve across the anterior spinal canal almost to the point of emergence of the right second thoracic nerve. It was possible to remove the tumor and invaded dura mater intact. After complete hemostasis the wound was closed without drainage.

**MICROSCOPIC EXAMINATION:** Elongated cells were arranged in moderately large whorls in a well vascularized stroma. The centers of many of the whorls were hyalinized and a few were calcified. Diagnosis: Psammomatous meningioma (fig. 1, c).

**SUBSEQUENT COURSE:** Immediately following the operation there was evidence of returning position sense in the toes and increased sensation to pin prick. Bladder control was good one week postoperative, and during the next several weeks the motor power returned rapidly. The patient walked well without a cane twelve weeks after the operation. The spasticity gradually diminished so that by January, 1939, her gait was normal and she was able to run and dance without hindrance. Neurologic examination on April 26, 1939, revealed very active tendon reflexes in the lower extremities, but no other positive findings. A report on March 9, 1940, stated that improvement had been maintained.

**COMMENT:** This case illustrates the tremendous advantage to the patient of an early diagnosis. Although the tumor in this case was technically more difficult to remove than the others in this series, nevertheless it was possible to restore normal functional activity.

The complete absence of radicular pain and the early paresthesias in this case suggested an intramedullary glioma of the spinal

cord. The situation of the tumor in the anterior part of the spinal canal with no involvement of posterior roots adequately explains the absence of pain.

**CASE 4.**—A colored woman, aged 44, was admitted to the Louisville City Hospital on Jan. 16, 1939, complaining of paralysis of both legs and pain in the left side of chest.

**HISTORY:** The patient had had difficulty walking because of stiffness of her lower extremities in 1937. Urinary incontinence occurred in January, 1938. However, she remained ambulant until after a fall to the floor five days before admission. Immediately after falling the patient was unable to use her lower extremities although she pulled herself into bed with her arms. For the first time she also noted pain in the epigastrium which was exaggerated by coughing.

**EXAMINATION:** With the exception of perforation of the nasal septum and irregular pupils, sluggish in their response to light, positive findings were limited to the trunk and lower extremities. There was no increase of tone in the completely paralyzed lower extremities. The knee jerks were symmetrically diminished and the ankle jerks were absent. Slight flexion reflexes and bilateral Babinski signs were present. Below the eighth thoracic dermatomes there was complete loss of sensation to pin prick, cotton, heat and cold with the exception of poorly localized sensation of pain to repeated painful stimuli. Above the eighth thoracic dermatomes there was partial loss of sensation as high as the nipples. Bilateral jugular compression caused severe epigastric pain.

Pale yellow cerebrospinal fluid was obtained by puncture at the third lumbar interspace. The initial pressure was 240 mm. of water. Repeated jugular compression caused no rise in pressure, but abdominal compression caused a rapid rise to 600 mm. with a rapid fall back to 240 mm. When a blood pressure cuff was placed around the neck and inflated to a pressure of 60 mm. of mercury, there was a slow rise of cerebrospinal fluid pressure to 480 mm. of water with a return to 400 mm. after release. These findings indicated an almost complete block.

Serologic studies on blood and spinal fluid were positive. The cerebrospinal fluid cell count was 4, the total protein was 240 mg. per cent and the Lange gold curve was 4443322211. Roentgenograms of the thoracic spine were negative. After the injection of 0.5 c.c. of lipiodol in the lumbar subarachnoid space, fluoroscopy revealed complete obstruction at the fifth thoracic vertebra with the patient suspended head downward.

Although it was known that the patient had syphilis of the central nervous system, it was considered highly probable that a spinal cord tumor was present. Nevertheless, the syphilologists insisted upon a therapeutic trial with iodides and bismuth, which proved ineffectual.

**OPERATION:** On Feb. 13, 1939, under local anesthesia the laminae of the fourth, fifth and sixth thoracic vertebrae were removed. The bone at this level was much more than normally vascular. When the dura mater was opened, a reddish tumor measuring approximately 2.5 by 1.5 by 1.5 cm. was found on the left side in a position ventrolateral to the spinal cord. Bleeding from large veins which entered the tumor on the left side was controlled by implants of muscle. Pain caused by traction on the tumor was relieved by applying 2 per cent spinal procain solution to the exposed roots. The involved nerve roots were divided, and the invaded dura mater was excised with the

tumor which was totally removed. After complete hemostasis the wound was closed without drainage. Transfusion was necessary at the termination of the operation.

**MICROSCOPIC EXAMINATION:** The cells were arranged in concentric whorls which had, in many instances, hyalinized or calcified centers. Vessels were numerous. There was invasion of the inner layers of the attached dura mater. Diagnosis: Psammomatous meningioma (fig. 1, d and fig. 2).

**SUBSEQUENT COURSE:** The patient made a rapid recovery from the effects of operation. Sensation had returned to a considerable degree one month later. Iodides and bismuth were continued through the postoperative period. Because of the slow convalescence it was necessary to transfer the patient to a nursing home two months following operation. At the time of transfer

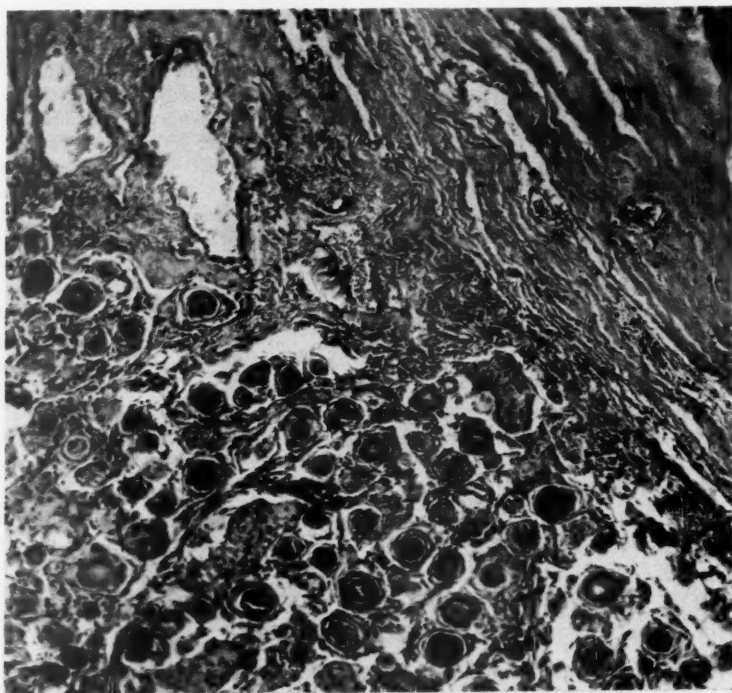


Fig. 2. Hematoxylin-eosin preparation magnified approximately 75 diameters. The invasion of the inner layers of the dura mater (upper right corner) by the neoplasm is clearly shown in Case 4. All stages of hyalinization and calcification can be found. Large vascular channels are clearly outlined in the upper left corner.

there was no voluntary motor control in the lower extremities, and lack of vesical control necessitated a retention catheter. However, there were no bed sores nor urinary infection. The patient died from unspecified causes six weeks after transfer to the nursing home.

**COMMENT:** Not infrequently the symptoms of spinal cord tumor become exaggerated or even appear for the first time following

trauma. In this case the rather severe symptoms preceding the relatively minor traumatic incident indicated the importance of a preëxisting lesion. The absence of fracture confirmed this view.

All cases of recent severe or complete paraplegia should be considered acute surgical emergencies until proven otherwise. In this instance the insistence of the syphilologists upon delay of operation for a therapeutic trial may have contributed to the unfavorable outcome. Syphilitic affections of the spinal cord rarely produce level lesions with subarachnoid block, and even when this syndrome results from syphilis, the lesion may well be surgical in type. For these reasons it is unwise to consider positive serologic studies a contraindication to surgery if the neurologic findings indicate a lesion demanding prompt treatment.

The necessity for unremitting careful nursing is shown by the rapidly terminal course after transfer of this patient from hospital to convalescent home. Only by complete prophylaxis of pressure sores and adequate treatment of incipient bladder infections can patients having severe spinal cord affections be given opportunity for recovery.

#### SUMMARY

Four cases of well-advanced spinal cord compression by meningeal tumor have been presented. The history and findings in three cases were typical of extramedullary tumor of the spinal cord while in one case (Case 3) an intramedullary origin seemed probable. All the patients showed evidence of advanced or complete subarachnoid block. Roentgenograms were not diagnostic in any of the cases. Lipiodol was used in one instance (Case 1) because of the uncertain sensory level and in another (Case 4) because it was necessary to convince skeptics of the presence of a surgical lesion in a patient with syphilis. In all four cases the tumors were completely removed. The results were inversely proportional to the severity and duration of spinal cord compression. The series of cases is unusual in that three of the four patients were negroes. Histologically, the four meningiomas, classified according to Cushing and Eisenhardt, fall into type 2.

#### CONCLUSIONS

1. The spinal meningiomas are outstandingly benign neoplasms which can be completely removed surgically.
2. Correct diagnosis of spinal cord tumors is possible much earlier than it is usually made.
3. Spinal meningiomas may not be as uncommon in the negro race as formerly suspected.

4. The presence of syphilis must not be evoked too readily to explain paraplegia which appears to be caused by a neoplasm.

5. Patients developing signs of spinal cord damage following lumbar puncture, spinal anesthesia or trivial injury should be investigated for spinal cord tumor.

I wish to thank Dr. Donald G. Henderson, Pathologist of Jefferson Davis Hospital, Houston, for the preparation of the photomicrographs used in this report.

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## AN EXPERIMENTAL STUDY OF THE EMBOLIC EFFECTS OF AIR AND OF CARBON DIOXIDE

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WITH progressive improvement in surgical technic and in the technic of anesthesia, the occurrence of sudden, unexplained death, during an operation or following an operation, has become infrequent. Most of us, however, recall such catastrophes. Personally it is felt that we have been too inclined to label them "deaths from embolism." Often the diagnosis of embolism is difficult to prove or to disprove, while the use of the term *embolism* serves somewhat to salve the surgeon's conscience in view of the feeling that fatal embolism is a rare but unavoidable accident.

When a blood clot obstructs a pulmonary artery or one of its major branches the diagnosis can usually be established. During life there is the wedge-shaped x-ray shadow and at autopsy, if the patient dies, the pathologist can demonstrate the infarct and find the clot. In the more mysterious conditions of *fat* embolism and *air* embolism, in contrast, the diagnosis is almost always open to question. If the pathologist fails to find any embolism the surgeon may still be unconvinced, for it is plausible that the obstruction of a single small artery to a vital center in the brain-stem or medulla might kill the patient and yet be difficult to find postmortem. On the other hand, the demonstration at autopsy of fat globules in the pulmonary capillaries does not prove that these globules were the cause of death.

Some years ago one of us (R. M. M.) assisted Dr. Edwin P. Lehman in experiments in which liquid fat or oil was injected into the femoral vein in dogs. It was found that unless the volume of the injection was large it did not cause death. While a blood clot may be of a size to block a pulmonary artery, fat droplets (or air bubbles) lodge as small particles in the capillaries of the lungs. The pulmonary capillary bed is exceedingly capacious and an extremely large volume of particulate matter is required to obstruct enough of it to interrupt the pulmonary circulation. Furthermore, the lung capillaries serve as an effective barrier preventing particles from reaching the left heart to be distributed as emboli in the systemic arteries. We found that the oil droplets lodging in the lung might set up a pneumonitis which killed the animal after some days.

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Presented before the Semi-Annual Meeting of the Texas Surgical Society, Dallas, April 1-2, 1940.

But only when the volume of oil injected exceeded 1.5 c.c. per kilogram of body weight, a quantity corresponding to more than 100 c.c. in a man of 150 pounds, only then was oil forced through the pulmonary capillaries to enter the systemic circulation and cause embolism of peripheral arteries. We measured the capacity of the marrow cavity of the femur; it was only two-thirds this amount. In other words, to cause sudden death in the dog it was necessary to pour into the femoral vein a femur-and-one-half full of oil. Naturally we became convinced that although fat embolism may often lead to a fatal pneumonia, sudden death from fat embolism must be rare.

This statement applies to the entrance of fat into a systemic vein. In a pulmonary vein a small amount of fat might cause fatal coronary or cerebral embolism. However, it is difficult to conceive of circumstances which would lead to the entrance of fat into a pulmonary vein.

The fear that accidental entrance of air into a systemic vein may result in death has been dispelled to a great degree by the repeated demonstration that large volumes can be injected into the veins of animals without fatal results. Dogs have survived single injections of as much as 34 c.c. of air per pound of body weight (Van Allen, Hrdina and Clark, 1929), while the least fatal dose was that reported by Harkins and Harmon (1934), 3.5 c.c. per pound of body weight of the dog—corresponding to more than a pint for a man of average size. Richardson, Coles and Hall (1937) tried a method of continuous injection at a slow rate and in one dog injected 3,910 c.c. over 87 hours before death occurred. Similar experimental results can be found as far back in the medical literature as one goes. In the 1880's Dr. Nicholas Senn debated with Dr. Samuel Gross and others as to whether the entrance of small quantities of air into peripheral veins was fatal or harmless. In 1889, in a demonstration before the Philadelphia County Medical Society, Dr. H. A. Hare injected 60 c.c. of air into the jugular vein of a twelve-pound dog without harmful effect. In *The Therapeutic Gazette* of that year Dr. Hare reviewed the literature back to the time of Magendie and concluded that "enormous amounts of air must enter a vein to cause death," and that "no such quantity can possibly find its way into a vein which has been injured with the knife of the surgeon."

Air which enters a systemic vein is churned with the blood in the right ventricle to form a froth. This process is accompanied by the loud "mill-wheel" murmur. Within a few seconds the froth is ejected into the pulmonary arteries to lodge in the pulmonary capillaries. Nitrogen is so sparingly soluble that the capillaries remain obstructed for many minutes, but the capillaries are such an effective

barrier that ordinarily none of the bubbles reach the left heart to lodge as emboli in the coronary or cerebral circulations.

While one is skeptical regarding the danger of sudden death from the entrance of fat or of air into a *systemic vein*, the entrance of air into a *pulmonary vein* is often fatal. Both on aspirating the chest and in thoracic operations the accident has occurred. Recent ideas have been founded upon the experimental work of Van Allen, Hrdina and Clark in 1929. These men found that the dog's maximum tolerance for air injected into a pulmonary vein was only 0.6 c.c. per pound of body weight. Furthermore, they stressed the principle of "air buoyancy," i. e., the tendency for air to pass into the uppermost vessels. In their dogs the arch of the aorta served as an air trap as long as the animal was in the dorsal recumbent, horizontal position. As a result the air entered the branches to the head and neck and the animals died of cerebral embolism with respiratory failure. Van Allen and his associates suggested that lowering of the head so that the great arch branches would be dependent should prevent this occurrence. Since that time many thoracic surgeons have kept the patients' heads low, yet sudden deaths have still occurred.

In the course of some experiments upon the heart several accidents led us to suspect that in the cat the chief danger from entrance of air into a pulmonary vein was coronary embolism rather than cerebral embolism. Consequently we studied the effects of injections of air into a pulmonary vein in 35 cats.\* Information was obtained along three lines. First, the fatal dose for the cat was about 0.5 c.c. per pound of body weight, with slight variations depending upon chance. Second, the manner of death was always the same—coronary obstruction—regardless of the animal's position. Within a second or two after the injection one saw air bubbles descending the coronary arteries. If the dose was minute they blocked only a few tiny branches; in that case they were absorbed in 15 to 20 minutes, causing no harm to the heart other than a few extra systoles. With larger doses the air filled both right and left coronary arterial trees. There it remained. At times a segment of blood interposed in the column of air would be seen to oscillate slightly with the beat of the heart but there was never any progression of the column to suggest an escape of air through the capillaries. This complete obstruction of the coronary arteries led to a rapid ischemic failure of the ventricles with dilatation within 2 or 3 minutes. In 5 or 6 minutes the dilatation was extreme. Although the animal was under artificial respiration, at this time it made convulsive respiratory movements, indicating that the respiratory center was still in good state. In

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\*For complete report see *Annals of Surgery* 112: 212-218, 1940.

only 1 animal of the 35 was there evidence of cerebral embolism; a convulsion occurred after a small injection. The same animal died later from coronary obstruction following a larger injection. Thus the cardiac mode of death was the rule although we varied the animals' positions.

As a third study we compared the effects of carbon dioxide with the possibility in mind that it might be relatively harmless in view of its solubility and its chemical affinity for the blood. Commercial tanks of carbon dioxide were found to be contaminated with air. We prepared pure carbon dioxide and found it to be harmless. We made repeated injections into pulmonary veins, some as large as 3.0 c.c. per pound of body weight, a quantity corresponding to 450 c.c. for a man of 150 pounds. In one animal we injected a dose of 2.0 c.c. per pound three times in four minutes for a total dose of 6.0 c.c. per pound. No lasting embolism resulted. The gas produced the typical murmur and filled the coronary trees. But in 15 to 20 seconds it was entirely replaced with blood. Ischemia of this duration did not disturb the heart's rhythm. We do not believe that the gas escaped through the capillaries into the venules, for we never saw bubbles ascending the coronary veins. Furthermore, if one watched large bubbles of carbon dioxide gas in a column of blood he saw them suddenly vanish as though they had been dissolved in the blood. Carbon dioxide is exceedingly soluble and reactive; we suppose its capacity as a weak acid to unite with the alkaline blood buffers accounted for its rapid disappearance.

This finding suggests several practical applications. Carbon dioxide might well be substituted for air to provide the desired collapse in closed intrapleural operations such as, for example, the endoscopic severing of pleural adhesions. Though its absorption is too rapid for lasting pneumothorax, it would be safe for the exploratory initial fill for pneumothorax when the physician fears his needle may enter a vein. Since carbon dioxide is much heavier than air it might be tried in open thoracotomy, but the probable admixture with air would make its value seem doubtful. It must be emphasized that only when the gas was pure was freedom from harmful embolism observed.

We have created pneumothorax with carbon dioxide in cats and in dogs without any apparent harm.

In conclusion it should be stated that the embolic effect of any gas requires an explanation. If blood passes through the smaller vessels, why cannot air? Apparently the lodging of the air bubbles in the vessels is related to the highly resistant film about each bubble. As long as the resistance of this film to rupture exceeds the

capillary pressure the bubble remains intact and obstructs the lumen of the capillary.

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## SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS WITH END RESULTS

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THE application of surgical measures to the treatment of pulmonary tuberculosis is a highly individualized matter. Any attempt at an arbitrary rule for the treatment of this disease defeats its own purpose. Medical management still remains the sheet anchor of the treatment of pulmonary tuberculosis; but, unfortunately, the advocates of the medical management usually yield to clinical compromise only when it has been forced upon them by the beneficial results obtained by surgery. This is too often postponed until the disease has reached a stage unsatisfactory for any plan of surgery.

Underlying all forms of treatment for the control of tuberculosis are the three basic principles, namely:

First. Rest.

Second. Relaxation.

Third. Collapse.

It was Diedwilder who, fifty years ago, made a plea for rest, sunshine and high caloric diet in the treatment of tuberculosis. Rest is still unchallenged as the first indication in the treatment, and all efforts of collapse therapy have for their ultimate goal a greater degree of rest for the affected lung. The mere decrease of bodily activity has been extended to include measures designed to restrict the respiratory movement. The basic purpose is to eliminate the elastic recoil of the lung and to reduce its bulk, thereby reducing toxemia and spread of infection through decrease of the activities of the blood, lymph, and air movements from the infected area. Relaxation and collapse of the lung are effected by interrupting the normal function of the various component factors of the thoracic cage, and by disturbing or inhibiting the respiratory excursions.

In one form or another, collapse therapy is the only important contribution to the treatment of tuberculosis in the last five decades. As a matter of fact, it is only ten to twelve years since collapse therapy has taken an active role in the treatment of tuberculosis. It is now estimated that from 50 to 80 per cent of patients in the sanatoriums of the country are receiving some form of collapse therapy. I am thoroughly convinced that as the surgeons become more proficient in the various technical procedures of pulmonary collapse, and when the results obtained justify the confidence of the medical men, many more cases will receive the benefit of surgical compres-

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Read before the Postgraduate Surgical Assembly (the eleventh annual meeting) of The Southeastern Surgical Congress, Birmingham, March 11, 12 and 13, 1940.

sion at a time when it has an opportunity to do its maximum amount of good.

In order properly to evaluate statistics, and the vernacular of collapse therapy control, I have been impressed by the classification laid down by the American Sanatorium Association, and the National Tuberculosis Association, in 1931, in which a definite plan or outline is given, and a suggestion of the type of case which falls under each plan. When the patient is first examined he will fall under one of the following three heads.

#### 1. THOSE PATIENTS WITH MINIMAL LESIONS

Invasion and slight infiltration of one or both lungs. Involvement not exceeding the total volume of lung tissue above the second chondrosternal junction in front, and the spine of the fourth and fifth vertebra laterally and posteriorly. No demonstrable cavities. Symptoms are negligible. Slight, if any, elevation of temperature or increase in pulse rate. Cough is not constant, and expectoration is usually small in amount or entirely absent. The tubercle bacillus may or may not be demonstrable.

#### 2. THOSE WHICH ARE MODERATELY ADVANCED

Lesions noted in this classification may involve one or both lungs, the combined extent of involvement not to exceed the equivalent of the volume of one lung. Infiltration with or without fibrosis extending to not more than one-third the volume of one lung. Cavity formation not exceeding 4 cm. Symptoms again may present no constitutional deviations from the normal, expectoration and tubercle bacilli may be absent. In this group, however, symptoms may become severe with marked impairment of function, both local and constitutional, loss of weight, acceleration of pulse, elevation of temperature, etc.

#### 3. THOSE CASES WITH FAR ADVANCED LESIONS

All findings referred to in the above groups are markedly intensified. There is usually marked impairment of function with dyspnea on slightest exertion. The patient's inability to carry on his normal vocation, marked constitutional weakness, anorexia, tachycardia, and feeling of impending dissolution. The cavity formation may be multiple and small or exceedingly large.

The American Sanatorium Association, and the National Tuberculosis Association, working conjointly, have also agreed upon the classification for patients about to be dismissed from treatment.

##### 1. APPARENTLY CURED

All symptoms must have been negative for a period of two years under the ordinary conditions of life. Constitutional symptoms must have disappeared, sputum microscopically negative, x-ray examination interpreted as healed.

##### 2. ARRESTED

All constitutional symptoms must have disappeared, sputum negative for tubercle bacilli, x-ray findings negative. Conditions must have existed for a period of at least six months, during which time the patient shall have had a moderate amount of walking exercises.

### 3. APPARENTLY ARRESTED

Constitutional symptoms must be absent, sputum negative, x-ray findings showing either stationary or retrogressive forms of lesions. Such conditions to have existed for a period of three months or more, during which time at least one hour's walking exercise twice daily is done.

### 4. QUIESCENT

Constitutional symptoms must be absent, sputum negative, x-ray findings showing evidence of stationary or retrogressive lesions. All symptoms must have been absent for two months, during which time a moderate amount of exercise has been indulged in.

If all of the men treating tuberculosis used the classifications outlined above, both for the cases under treatment and for the terminology upon discharge from treatment, I believe it would be easier for us to arrive at a more correct evaluation of statistics. There is today a group of optimistic medical men in this country who believe that tuberculosis is rapidly becoming controlled, and within a few decades will cease to be a problem. I would remind this group that the National Tuberculosis Association makes a careful estimate that there are now 700,000 cases of active tuberculosis in this country and that about 100,000 patients are being hospitalized in the course of a given year. In the last survey made there were 2,026 fewer sanatorium beds than there were tuberculosis deaths here. It is still the leading cause of death between the ages of 15 and 45 years of age.

John Alexander made a survey in 1937 in which he showed that approximately 49,000 patients were receiving treatment by some form of collapse therapy each year. This was approximately 30 per cent of the 163,000 patients treated in sanatoriums during that year. He also stated that these figures should read 106,000 patients or 65 per cent of the total number of patients receiving treatment. In other words, he believes that the number receiving surgical collapse of one form or another should be multiplied by 2.2 in order to bring the number up to his sincere conviction that 50 to 80 per cent of all patients admitted to sanatoriums should receive some form of collapse therapy. Alexander makes this timely statement,

The time is rapidly coming, I believe, when minor revocable collapse therapy operations, in conjunction with sanatorium treatment, will be universally used in the leading tuberculosis clinics for early active lesions because physicians will no longer be willing to gamble upon any but the most effective possible treatment in so insidiously dangerous a disease as tuberculosis.

How shall we decide which cases require surgery and which require only bed rest, sunshine and diet? A tuberculosis cavity is to all intents and purposes an abscess cavity. To that larger group of surgeons who do general, as well as thoracic surgery, the question of abscess closure in the lung and below the diaphragm brings up

the different factors influencing the proper closure or obliteration of the abscess.

Overholt some years ago drew attention to the similarity and behavior of abscess closure in different regions of the body. What are the factors influencing closure of abscess with central tissue destruction in the pelvis? Pressure on all areas is exerted by the abdominal viscera, thus crowding the abscess to the center. Thickening fibrosis of the abscess wall occurs and either absorption takes place or drainage is instituted. By the same token, granulation tissue from within and fibrous contraction of the walls from without, serve to reduce the cavity space caused by tissue necrosis. In pulmonary abscess formation there are not seen exactly the same factors. Certainly, the surrounding visceral pressure and the walls of the thoracic cage are fixed and held separate by fixation to the chest wall. When lung tissue is lost there is a corresponding reduction noted between thoracic volume and lung volume. Then the chest wall becomes rigid, the abscess wall receives no compression from without because the pressure in the space around the lungs is normally subatmospheric.

If the cavity in the lung is connected with the bronchus, the intrapulmonary and intracavity pressure is greater than that surrounding the lung; and, therefore, the force exerted by natural tendency is toward the periphery rather than toward the center; it follows that once a pulmonary cavity gets a reasonable start, of say 2 to 3 cm. in size, its chances for spontaneous closure are indeed meagre and it must depend upon extraneous influence for adequate pressure to approximate the walls and induce healing.

It is here that the value of phrenic interruption is appreciated. When one realizes that the outward expansion is always greatest and that the cavity is therefore open wider from center toward the periphery during the inspiratory effort, it naturally follows that the more inhibitory influence exerted upon the inspiratory effort the more stationary will the cavity become and, therefore, the greater opportunity for healing. Many times the hemithorax is lessened by a shifting of the mediastinum, the trachea, or heart; by a compensatory emphysema in the opposite or unaffected lung; by elevation of the diaphragm; by pleural fixation from adhesions following pleuritis; or by fixation of the mediastinum without a favorable shifting in position to the affected side. All of these factors prevent rather than augment the spontaneous closure of intrapulmonary cavitation.

In order more properly to evaluate the best methods to be used and the most satisfactory end results in collapse therapy in tuberculosis, I find myself more and more interested in the basic principles of structure and function of the lungs. One must know the nor-

mal in order to deal properly with the abnormal, whether caused by disease, destruction, or compensatory rearrangement through some type of pulmonary collapse. Even the surgeon should know in considerable detail, the mode of infection, its avenues of pathologic extension, and its sacrifice of function to the human economy, in order to help determine the type of operation most applicable for a given case and its lesion.

In order to combat the insidious battle waged by the tubercle bacillus one should be familiar with some of its characteristics. Rod-like in appearance, chemically composed of a fraction of protein, a polysaccharide, and lipid, the latter constitutes a fatty capsule weighing one-half as much; this capsule is responsible for the acid-fast property of the organism. The fact that many cases of tuberculosis go unrecognized because the organism cannot be detected in the sputum is well known to clinicians: this is because in staining by the Ziehl-Neelsen method as many as 100,000 bacilli per cubic centimeter must be present before they can be detected. Of course, culture and inoculation into guinea pigs, according to Boyd, is 1,000 times more sensitive but this method involves the undesirable delay of four to six weeks for the diagnosis.

Tuberculosis is amazingly widespread. It has been shown by compilation of statistics that 15 per cent of children before the age of 10 years are infected; 30 to 60 per cent before the age of 20 years; and 99 per cent of all people above middle life show some evidence of infection at sometime in their lives.

From the hour of successful invasion of its host, the tubercle bacillus is engaged in constant battle for its existence against the polymorphonuclear leukocyte, the first natural defender of the body, down through the various combatant forces and culminating in the intrepidity of the twentieth century surgeon.

The little organism is no sooner at rest in its new home than its offensive presence is recognized by the polymorphonuclear leukocytes. They surround the bacillus, which they cannot destroy; actively phagocytic they tend to hold in abeyance the spread of the bacilli through contiguous tissues until other and more powerful natural forces arrive. Within twenty-four hours the polymorphonuclears are replaced by monocytes. These more phagocytic tend more effectively to break down the tubercle bacillus by dissolving its lipid capsule and causing its dispersion throughout the cytoplasm. The monocyte is thus transformed into the epithelioid cell which is the most characteristic feature of the tuberculous reaction. These epithelioid cells fuse to form the next line of defense, or offense; namely, the giant cells which are much larger and contain many nuclei. Giant cells do not appear as a rule until necrosis has begun. They remove and digest dead tissue. Within five to ten days the

lymphocytes form a ring around the periphery of the lesion. They are smaller than giant cells, and play a heavy role in the body's defense against the tubercle bacillus.

The presence of the bacillus with its three or four lines of defense cells is now recognized as a small translucent nodule, visible to the unaided eye; this tubercle varies in size from a millet seed to split grain of rice. These body processes will not remain dormant long, and in probably two weeks time caseation or coagulation necrosis occurs. Clusters of these tubercles may fuse together in massive necrosis, the central cells lose their nuclei, cellular architecture is lost, softening and liquefaction occur, and thus we arrive at the cavity formation about which we are most concerned.

#### HOW DOES TUBERCULOSIS SPREAD THROUGHOUT THE LUNG AND OTHER PARTS OF THE BODY?

The infection enters the body in three ways, namely, inoculation, ingestion, and inhalation. The organism, while non-motile itself, may ride to new pastures in the phagocytic cells. It may spread also by natural channels, e. g., from kidney to bladder, or by its most logical route, the lymphatics, because the disease is primarily one of lymphoid tissue. Finally, when a focus ruptures into a blood vessel, usually a vein, the organism may be carried through the blood stream throughout the rest of the lung, or into other organs of the body. Healing of the lesion, when it occurs, is brought about by a process of surrounding fibrosis, and the deposition of lime salts in the remaining glandular tissue. There is always fever when tuberculosis is active, due to the absorption of toxins. This is further augmented by a secondary or mixed infection.

Cough, a most troublesome symptom, is usually due to thickening of the larger bronchi since they are more sensitive than the bronchioles. If pain is present, it is usually due to a concomitant pleurisy. Sputum may be scant as in miliary tuberculosis or most copious after cavity formation with drainage into the bronchi.

Boyd makes this timely statement, "hemorrhage is either the end of the beginning, or the beginning of the end." In the early stage it is due to erosion of a minute vessel during the caseation or softening period, while in the later stage the cavity may be so large as to leave blood vessels literally spanning them, which finally yield to tension, stress or erosion, and may cause a fatal hemorrhage. Physical signs are often misleading due to thickened pleura, but when present have a helpful interpretation; e. g., moist rales intensified by coughing suggest loose caseous material. These rales become coarser as the cavity enlarges. The long, tedious search for all of the physical signs has been replaced by the use of the x-ray.

Given the disease as outlined, what shall our advice and procedure be? The most common thoracic operations used in the treatment of pulmonary tuberculosis are as follows:

1. Pneumothorax.
2. Phrenic nerve interruption, either temporary or permanent.
3. Scaleniotomy.
4. Intercostal neurectomy.
5. Intrapleural pneumonolysis.
6. Extrapleural pneumonolysis.
7. Apicolysis.
8. Thoracoplasty.

To Carson, in 1819, and to Carlo Forlanini of Milan, who published the first papers on the production of pneumothorax artificially, we owe much of our present day conception of pneumothorax. Because pneumothorax can be made available to the greatest number of patients suffering with tuberculosis, I regard it as the most universally beneficial form of collapse therapy. However, it is not without its dangers and should be given most cautiously in the beginning, with the introduction of only 200 to 400 c.c. of air, given slowly, and under closest observation. Shifting of the mediastinum may cause embarrassment of the heart and result in shock of varying degrees or death.

The principle consists of raising the negative intrapleural pressure toward or to the atmospheric level by the introduction of air into the pleural cavity. This method, in suitable cases, offers a most effective means of controlled collapse; however, pleural adhesions frequently limit its application. When pleural adhesions are recognized, sometimes they may be severed through intrapleural pneumonolysis after the method of Matson. This method of course has limited application and for that reason, perhaps, is responsible for the development of the extrapleural pneumonolysis. The latter is designed to afford localized collapse of the affected portion of the lung, with a minimum of sacrifice of the unaffected portion. In this procedure the parietal pleura is stripped free from the ribs by gauze and blunt dissection, until a cavity is created between the pleura and the ribs. Various procedures have been instituted to maintain this collapse, namely: paraffin pack, distensible bag, saline solution. Personally I believe that this method will not become popular. There are objections to pneumothorax, inasmuch as many cases develop pleural effusion which may or may not become purulent in character; the absolute necessity of regular and frequent refills; the obliteration of the pleural cavity with adhesive pleuritis, and the parietal pleural fibrous bands which prevent collapse by the introduction of air.

T. G. Eaton of Toronto collected 3,381 cases treated by pneumothorax by fifteen authors. In 928 cases or 27 per cent, collapse was impossible and in 1,468 cases or 44 per cent, collapse was only partial.

Empyema occurs in 2 per cent of early cases and 4 or 5 per cent of far advanced cases.

Mortality of all stages of the disease treated by pneumothorax is 5 per cent.

Scalenotomy has a definite value inasmuch as it assists in lowering the dome of the apex of the lung and, when associated with intercostal nerve block, is particularly helpful in combating the compensatory increase in intercostal activity which one sees after phrenic block. The intercostal block is usually done on the second to the eleventh intercostal nerves, and makes a strong contribution toward quieting the respiratory influence and further lung movement. These methods, however, are not universally used because of varying results.

#### PHRENIC NERVE INTERRUPTION

1. Temporary, by crushing.
2. Permanent, by cutting.
3. Permanent, by exeresis.

Because Stuertz could not collapse a diseased lower lobe with pneumothorax on account of pleural adhesions, he proposed an operative procedure designed to paralyze the diaphragm with the hope that the paralyzed hemidiaphragm would cause pressure upward and assist in closing the cavity. This was done in 1911; since that time, it has been a valuable adjunct in the treatment of cavernous tuberculosis. The phrenic nerve normally arises from the third, fourth, and fifth roots of the cervical plexus. It passes downward and forward, crossing the anterior scalene muscle at the lower third. It then passes on into the thorax, behind the subclavian vessels, through the lateral space of the mediastinum to spread its distribution rather widely over the dome of the diaphragm. It is probably the only motor nerve of this important muscle; therefore, its interruption gives desired results when paralysis of the diaphragm is indicated.

As generally accepted, indications for phrenic nerve interruption are:

1. Supplementary to pneumothorax and to decrease the number of refills.
2. When adhesions or other factors render pneumothorax unsatisfactory.
3. To control profuse or repeated pulmonary hemorrhage.
4. To collapse cavities in basal tuberculosis.
5. To insure rest to lesions in cases without cavity formation.

6. To assist collapse when a lesion exists between base and diaphragm.
7. To sustain partial immobilization when pneumothorax has been discontinued.
8. As a preliminary to thoracoplasty (not universally accepted).
9. As a supplement to thoracoplasty to increase collapse and immobilization.
10. To aid in controlling basal bronchiectasis.

Phrenicotomy is usually thought of as the procedure of choice in basal tuberculosis, yet Wolfe states, "apical cavities are as definite an indication for the operation as are basal ones," and Orsos says, "the greatest pressure is exerted in the apex of the lungs, and secondly, perhaps, when the mediastinum has not been fixed, that a shifting with pressure on the contralateral lung may be so great as to cause marked embarrassment of the cardiorespiratory function." This operation, by allowing an elevation of the diaphragm, reduces the lung volume by one-third to one-fourth its normal. It is usually followed by increased expectoration, probably due to the squeezing out of toxic products from the cavity and hilum. Instead of the radical operation, I believe it is the consensus that probably 90 per cent of the first phrenic nerve interruptions should be temporary.

The largest series of results I have been able to obtain are those of Nehil and Alexander with 654 cases; Wirth and Von Jasi, 600 cases; E. J. O'Brien, 4,000 cases; and Alexander, 2,100 cases. An average summary from this extensive group of cases shows that more than 55 per cent have fulfilled the expectation of the surgeons; 30 per cent were ineffective, probably because of accessory phrenic nerves; and the remaining number varying in results from poor to complete failure. Alexander concludes that phrenic paralysis was the principal cause for apparent cure or arrest of the disease in 34 per cent of his cases and improvement in 35 per cent more. Therefore, he regards it as a factor of unquestioned value in the treatment of tuberculosis.

#### TECHNIC OF PHRENIC NERVE INTERRUPTION

These operations may be performed under local anesthetic, with or without moderate narcosis. A transverse incision is made along the folds of the skin in the neck, about 6 cm. above the clavicle and at the posterior border of the sternocleidomastoid muscle. The skin and platysma being divided horizontally, the muscle planes are freed by blunt dissection; the sternocleidomastoid retracted forward and the inferior belly of the omohyoid elevated; the fat and connective tissue carefully opened; the scalenus anticus muscle having been identified, upon it is most usually seen the white glistening phrenic nerve crossing obliquely from behind forward. Pinching the nerve dilates the corresponding pupil, gives sharp quick pains

in the shoulder through its close association with the supraclavicular and supraacromial branches of the cervical plexus, and usually causes spasm of the diaphragm.

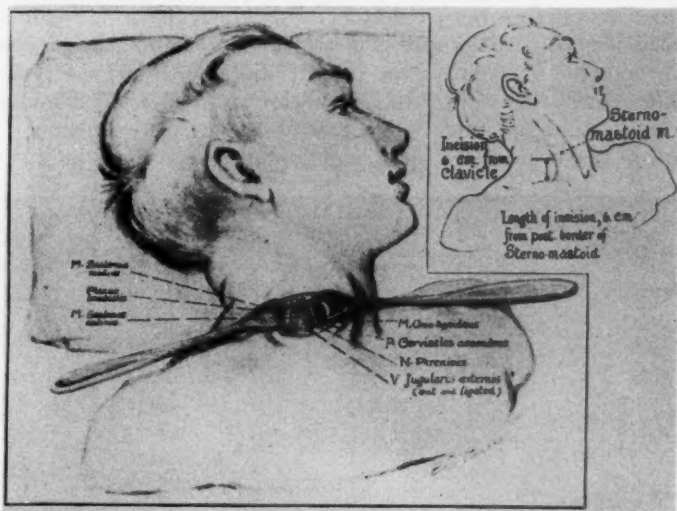


Fig. 1. Technic of phrenic nerve interruption.

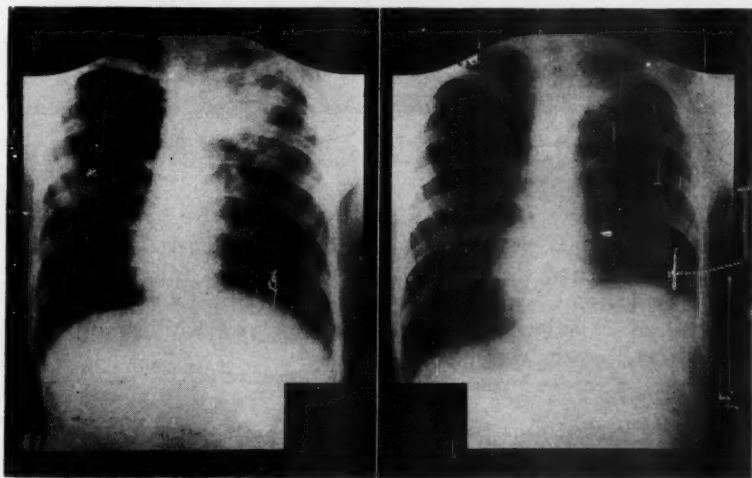


Fig. 2. The x-ray on the right shows the rapid improvement in tuberculosis of the upper part of the right lung after interruption of the phrenic nerve. Note elevation of diaphragm.

Having assured one's self of the absolute identity of the phrenic nerve, which may sometimes be mistaken for the vagus, the nerve

is freed, injected with small amount of 1 per cent procaine hydrochloride solution, and crushed obliquely at not more than two points. When and if, in the judgment of the operator, a permanent interruption should be done, the distal end of the nerve is caught in a Proctor phrenicotomy forceps and slowly evulsed. If it breaks, it is usually due to too rapid evulsion or because of a large accessory branch joining it below the clavicle. Sometimes these accessory branches form a triangle with the subclavian or internal mammary vessels at the apex, and undue tension during the evulsion may therefore result in troublesome hemorrhage. If as much as 12 cm.

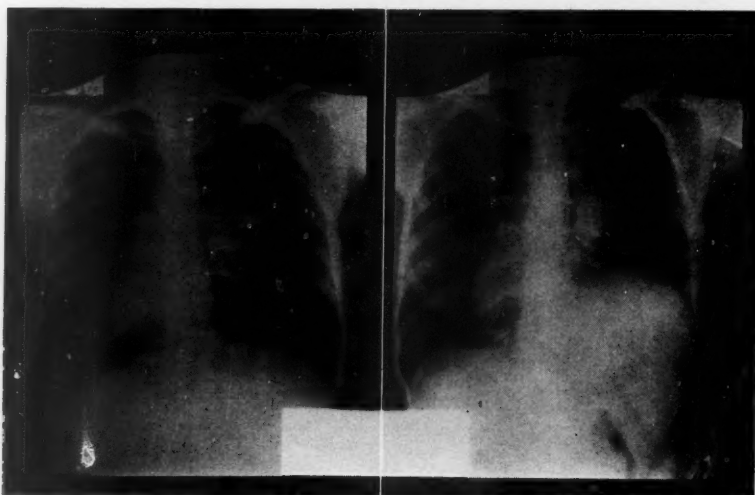


Fig. 3. Cavitation in the upper part of the right lung has resisted phrenic nerve interruption supplemented with pneumothorax.

of the nerve have been removed, the paralysis to the diaphragm will be satisfactory. If not, one should identify the fifth root of the cervical plexus and search for other innervations lower down. If only phrenicotomy is decided upon, a section of 6 to 12 cm. should be removed. The incision is closed with one or two skin clips which are removed on the second or third day.

#### SCALENIOTOMY

The three scalene muscles are accessory muscles of respiration. It was suggested by Gale and Middleton, in 1930, that severing of these muscles would be a great adjunct in the treatment of pulmonary tuberculosis. This procedure has been recommended in the presence of an apical lesion to relieve the pull of adhesions and promote the collapse of the apex in combination with phrenicotomy and also preliminary to thoracoplasty. These steps of the operation

are carried out through an incision much as that employed for phrenicotomy. Incision is made 6 cm. above the clavicle and immediately posterior to the clavicular part of the sternocleidomastoid muscle, and the tissues are penetrated through blunt dissection down to the scalene muscle. Each muscle must be definitely identified, infiltrated with a small amount of procaine, and separated from surrounding structures. A curved hook is passed around the muscle and then it is carefully severed. Structures to be avoided are the

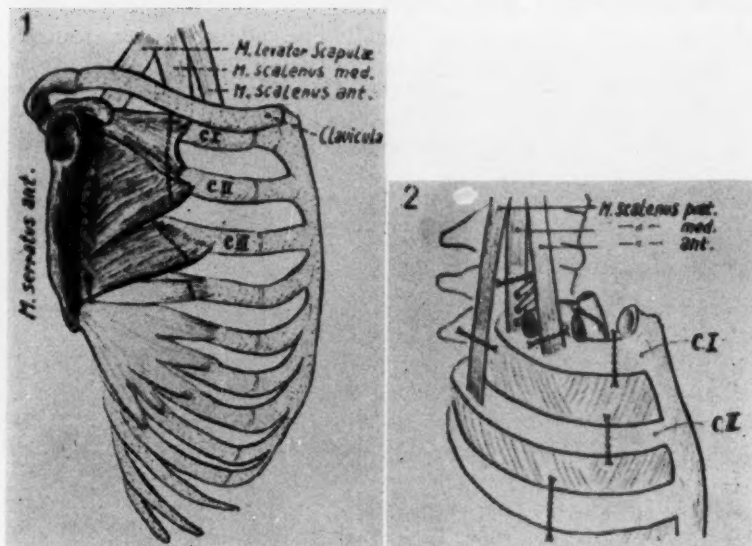


Fig. 4. Position and line of incision for operation on the scalene group of muscles. After Semb.

subclavian vein and artery, the transverse cervical and posterior scapular arteries, branches of the brachial plexus and the long thoracic nerve. It will be remembered that the scalenus anticus and medius muscles are attached to the first rib; the scalenus posticus being attached to the second rib should be severed at a lower level. The procedure may best be carried out in conjunction with phrenic paralysis, or with intercostal neurectomy.

As stated above, at the present time artificial pneumothorax in stages without adhesions seems to yield by far the best results of all of the different methods used for collapse. Its effects are not only ascribed to an act of compression, but rather to a relaxation, a liberation of the lung to enable it to retract itself. Effective pneumothorax liberates the lung from the surface of the thoracic wall at the side, in front, and behind, as well as at the top and bottom,

leaving the lung attached to only a limited area of the mediastinum corresponding to the hilum.

More than 90 per cent of the cavities which are treated by thoracoplasty are localized in the upper lobe, especially medially and posteriorly. It is not always necessary or desirable to collapse the entire lung. The most important problem in thoracoplasty is a free mobilization of the upper lobe. The operation, as performed by Sauerbruch and others, mobilized a limited area of the posterior part of the thoracic wall allowing collapse to occur mainly from the side and, to some extent, from behind. The collapse was most effective over the lateral part of the lung and decreased toward the apex and downward toward the base. Roentgen examination many times after the operation showed the cavity still present and, in some instances, reduced but very little in size.

#### WHAT TYPE OF CASE SHOULD HAVE THORACOPLASTY?

The ideal type of person to insure the maximum of benefit should have the following factors:

1. Cavernous lesions of the productive type.
2. Adequate cardiac reserve.
3. Well nourished, but not too fat.
4. Preferably in the age bracket from 20 to 50 years.
5. Patients whose cavities have resisted pneumothorax and bed rest.
6. Contralateral lung sound or with minimal involvement.
7. Lesions under two years' duration.
8. Vital lung capacity above 2,000 c.c.

A fresh exudative lesion in the good lung, though small, will often become most active, and will spread rapidly after thoracoplasty on the opposite side. This, to my mind, is a definite contra-indication to thoracoplasty. When both sides are involved it is safer to use pneumothorax on the lesser affected side and wait for improvement.

#### TECHNIC

Carl Semb of Oslo, whom I had the pleasure of seeing two years ago at his clinic in the state hospital and at the Vardaasen Sanatorium, has reemphasized the importance of adequately handling the apex of the lung, securing adequate and complete collapse in order to obtain the maximum results for the patient. As pointed out by Bull, the five or six upper ribs are generally far less mobile in their cartilage than the subjacent ribs, and show very little ability to swing backwards. Particularly is this true of the first and second ribs. When these ribs fail to swing backwards, the collapse from the side is, of course, reduced. Then an effective collapse from the side over the upper area of the lungs generally demands a section

of large parts of the upper ribs, especially the first and second. The thoracic wall is suspended and distended to some extent by the upper ribs, especially the first and second. These ribs are connected with each other by intercostal fascia and muscles: if we omit resection of the first rib, we obtain a relatively slight change of the thoracic wall and the collapse from the side is greatly reduced. The first rib has rightfully obtained its title as the keystone of the thoracic arch. The anterior scalene muscle attaches only 2 or 3 cm. from the sternal cartilage. Therefore, this portion of the first rib

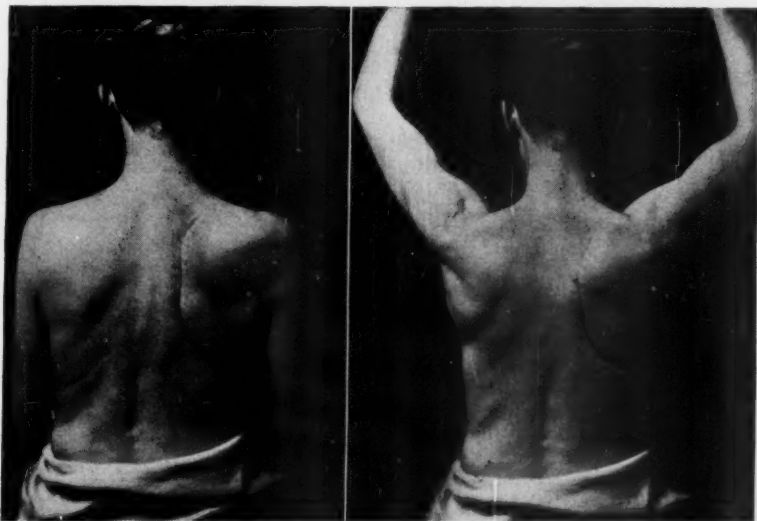


Fig. 5. On the left is shown the line of incision in thoracoplasty. On the right is illustrated that postoperative function is little impaired if careful attention is given to the muscle structure of the back.

is of great importance in the desired collapse of upper stage thoracoplasty. Many times if only a middle section of the first rib is removed, the action of the anterior scalene muscle as well as the medius prevents the collapse of the apex of the lung because their insertion and functions have not been interfered with. Semb, therefore, lays great stress on the removal of the third, second, and first ribs, and complete severance of the scalene muscles, with a careful separation of the endothoracic fascia. This may be carried out either by blunt or sharp dissection, being careful, at all times, to stay extrafascially. When this has been done, there occurs a simultaneous collapse of the thoracic wall as well as the lung.

At the time of my visit to Semb's clinic, he had performed 133 cases of extrafascial apicolysis in conjunction with thoracoplasty,

and only 16 of this number demanded re-operation. In two series reported more recently, of 250 operations performed he shows:

- 6 per cent mortality within six months.
- 5 per cent mortality after six months.
- 90 per cent cavity closures.
- 86 per cent negative sputum.

In another and still later series of 149 cases he reports:

- 3 per cent mortality within six months.
- 3 per cent mortality after six months.
- 93 per cent cavity closures.
- 91 per cent negative sputum in living patients.

His x-ray evidence, supported by many of the patients seen in person, convinced me that Semb's procedure is well worth careful consideration.

Approach for thoracoplasty is obtained through a posterior paravertebral incision, made midway between the posterior edge of the scapula and the vertebral spine, the arm being drawn forward. The incision begins at a point 1 or 2 cm. above the scapular spine, being careful not to injure the upper portion of the trapezius muscle. It extends downward and swings around the angle of the scapula to the midaxillary line, and further if necessary. Freedom with the incision may be exercised in the lower portion of the thoracic wall, but there is an important limit to the upper portion of the incision because injury to the trapezius muscle may impair the mobility of the arm. The incision is carried down through the rhomboideus major muscle and many times through the rhomboideus minor and the upper portion of the latissimus dorsi. The levator scapulae is preserved when possible. The scapula is then lifted upwards, the attachment of the anterior serratus muscle to the four uppermost ribs is severed to permit greater mobility of the scapula. At the attachment to the first and second ribs, troublesome hemorrhage may be encountered which it is desirable to avoid if possible. With the scapula well forward, the field of operation becomes clearly visible. One can see into the axillary fossa and forward toward the center of the chest. The first rib can be palpated without difficulty and the course of the large neurovascular trunk satisfactorily identified. The stripping of the periosteum begins at the third rib, after which the rib is resected, the second rib, and finally the first rib.

When exposing the first rib, the posterior and medial scalene muscles are divided. The first rib may be severed in the center, the anterior portion drawn downwards and backwards, which brings into view the anterior scalene muscle close by and attached to the neurovascular trunk. This is carefully pushed back with gauze pad and divided.

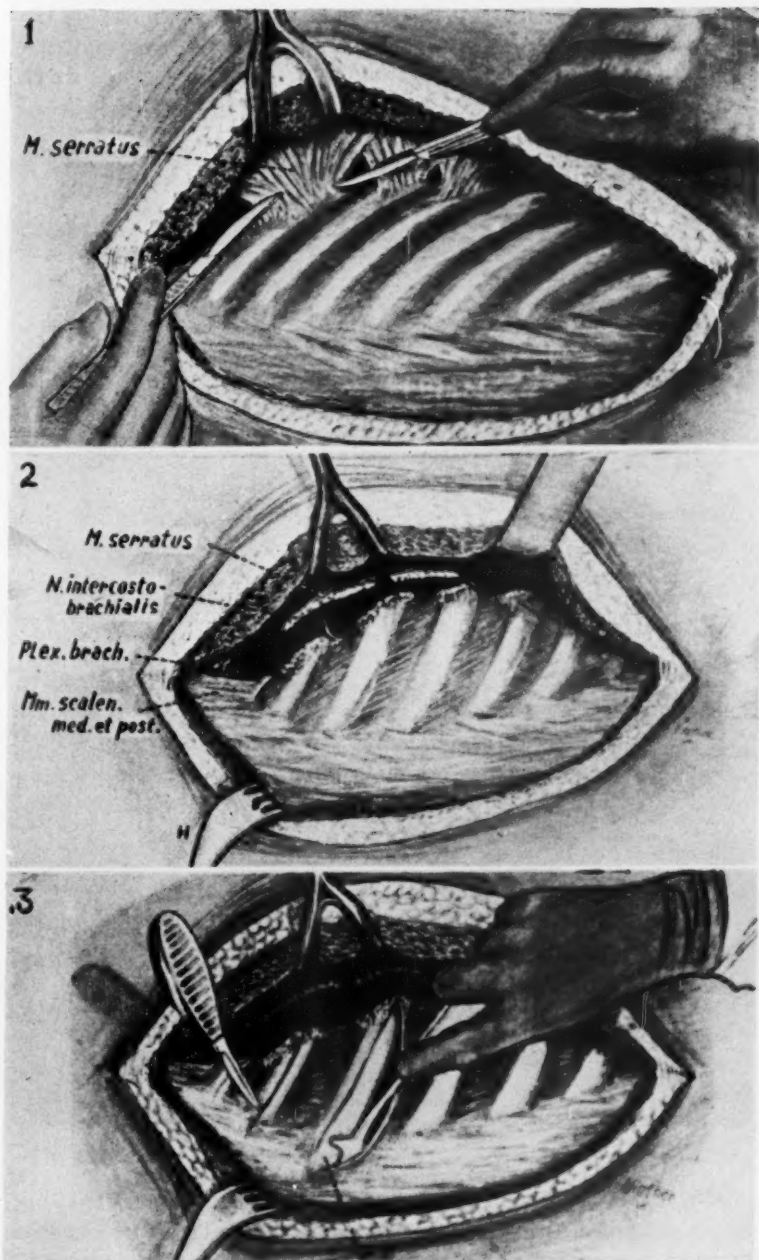


Fig. 6. Approach to the apex of the lung. After Semb.

The apex is now loosened from the neurovascular trunk and the extrafascial apicolysis begun. There are many small bands of connective tissue known as Sibson's fascia and Sebileau's bands which often times have to be tied and severed because of their attachment

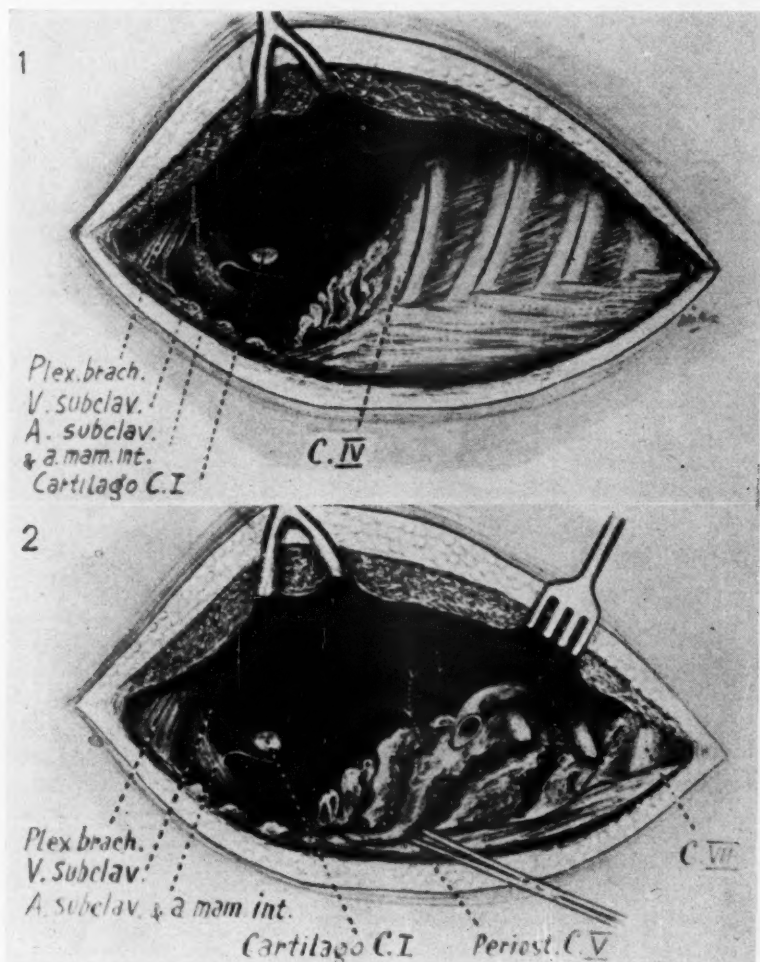


Fig. 7. Extrafascial apicolysis. After Semb.

from the scalene group of muscles to the pleural dome. They, of course, interfere with the downward collapse of the apex. Careless injury of the sympathetic nerve fibers along the medial portion of the first rib often results in Horner's syndrome as evidenced by

sinking in of the eyeball, ptosis of the upper lid, constriction of the pupil, and narrowing of the palpebral fissure.

At this point the apex of the lung is in close connection with the mediastinum. Usually this connection is loose and may easily be

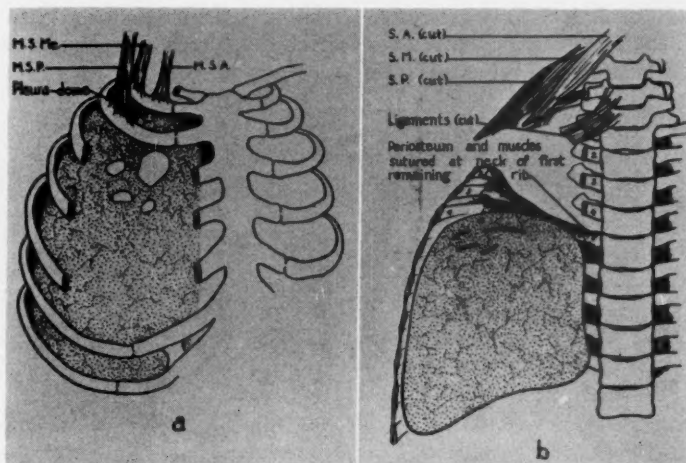


Fig. 8. Collapse obtained by scaleniotomy combined with extrafascial apicolysis. After Semb.



Fig. 9. Apical lesion of the right upper lung. On the right an x-ray, taken five years after the removal of the first eight ribs, shows apparent cure.

separated bluntly. The greatest of care must be exercised to avoid perforating the mediastinal cavity during this separation.

In the average case of cavitation of the apex, the lung drops to

a level of the third or fourth rib posteriorly and below the cartilage of the first rib anteriorly. This is usually adequate except in the case of large cavities situated posteriorly when the mobilization should be carried past the periosteum of the third and fourth ribs posteriorly. The intercostal bundles and periosteal beds are carefully dissected and removed. Saline solution may be instilled into the apex for its compression effect and, rarely, a rubber dam is left for two or three days.

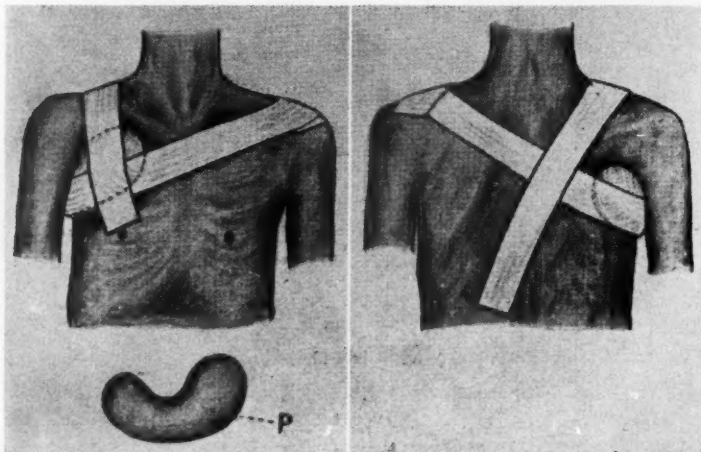


Fig. 10. Compression pad used by Semb to assist in maintaining compression of the apex downward and inward.

The hemostasis must be done very carefully. Each structure is closed and returned to its fellow of the opposite side, the arm should be returned as near to normal as possible in order that the scapular angle be reconstructed as it was prior to the operation. Perhaps the greatest danger in this operation is injury to the subclavian vessels and resulting air embolism. Therefore, the greatest of care is urged again in dealing with the large vessels and in loosening the connection from the apex of the lung to the mediastinum.

Holman suggested the removal of the lower one half to one third of the scapula in upper lesions above the fifth rib in order to secure a more adequate compression collapse. Personally, I have seen two cases in which this procedure has been carried out: it left an unsightly scar, lack of symmetry in the back, and interference with the movement of the shoulder.

The second stage is carried out much after the fashion of the first, usually ten days to three weeks intervening. Three to four ribs at each setting seems to be the safe procedure and rarely is it necessary to remove more than eight or nine ribs in order to effect

a maximum of compression. The seventh rib must always be removed when coming from above downward, otherwise the scapula will hang behind it. Careful dissection, gentleness in handling tissue, always working outward, the greatest amount of speed commensurate with careful work, cyclopropane anesthesia because of its high oxygen content, and a well trained surgical team, are most vital points.

#### END RESULTS

Leslie and Anderson, in 1935, published a review of 1,124 cases in which collapse therapy had been performed. Pneumothorax, phrenic nerve interruption, etc., were used in 18.8 per cent, thoracoplasty, 13.1 per cent, various minor collapse procedures in 68.1 per cent. In 420 of these patients discharged from the Michigan State Sanatorium with six months or more sanatorium care, 75.5 per cent of the cavities had closed.

In a series reported by Grimm and his associates of 100 cases on whom 180 thoracoplasties were performed, 76 were far advanced and 24 were moderately advanced, according to their diagnostic classification. A follow-up after four years' observation disclosed 9 patients dead, 5 with no activity, 27 slight activity, and 59 patients were well and working.

Fales and Beaudet collected a series of 320 cases treated at Veterans Hospitals: 182, or 56.9 per cent, had had pneumothorax with no improvement, 223 of the 320 patients had had some form of phrenic nerve interruption, 80 cases were treated with thoracoplasty, and 7 by intrapleural pneumonolysis. In this series, phrenic nerve interruption resulted in disappearance or diminution of cavity in 58.3 per cent of cases, 35 cases were much improved; in 18 cases no improvement was noted, and in 10 cases the patients were made worse. Eighty of the 320 cases were treated by thoracoplasty, 77 of these were far advanced, and 3 were moderately advanced. After three years, of these 80 cases, 66.7 per cent were definitely improved and 33.3 per cent remained stationary.

Trout reviewed a series of cases in 1924 to 1932 and showed that 33 per cent of patients receiving thoracoplasty were well and working after five years, 33 per cent more were apparently arrested, or a total of 66 per cent were entirely or partially cured.

Hedblom collected a series of 3,762 patients having received surgical compression therapy. Apparently cured, with negative sputum, negative x-ray and clinical findings and able to work, were 35 per cent, arrested 32 per cent, died 33 per cent.

In my own series of 320 phrenic nerve interruptions, 65 per cent of the patients are still alive, either working or definitely improved; 22 I am unable to locate and 13 have died. I have performed 50

thoracoplasties with 1 death due to embolism; 1 other patient died from cardiac failure three months after operation although she had gained weight, her cough had subsided, and sputum was negative at the time of her death. Another death occurred ten days post-operatively from cardiac insufficiency. Six other patients died from an extension of the original disease. The remainder of my series are still alive, some working, some remaining in the sanatorium under treatment, but all show definite improvement.

Finally, it has been shown that 90 per cent of active advanced pulmonary tuberculosis cases are dead within five years. Surgical collapse has reduced this number to 70 per cent or below, and certainly any method of treatment which will save 20 per cent of lives justifies its existence.

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## INTRAVERTEBRAL AND INTRATHORACIC BLASTOMYCOMA SIMULATING DUMB-BELL TUMOR

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**S**INCE the original observations of Gilchrist, in 1896, much has been written on the subject of blastomycosis. Cutaneous and systemic forms of the disease have been recognized and described in detail by Montgomery and Ormsby, Stober, Wade and Bel, and others. Important features regarding the isolation and identification of the causative organism have been presented by many investigators including Stoddard and Cutler and more recently by Martin and Smith whose monographic works provide us with very complete reviews. Although reference is made in this article to recent terminology adopted in connection with the organisms that cause blastomycosis and certain allied conditions, it is not our intention to enter into the controversy regarding the classification of pathogenic yeasts and fungi. We merely wish to record an unusual case of systemic blastomycosis that presented a difficult problem in clinical diagnosis and to present a brief summary of certain pathologic features which enable one to distinguish the condition from coccidioidal granuloma and torulosis.

### REPORT OF CASE

A white farmer, aged 44 years, registered at The Mayo Clinic on May 15, 1939. He complained of weakness, loss of weight, and pain in the left scapular region of one year's duration. One year prior to admission the patient had noticed general malaise and a tendency toward somnolence. A gradual loss of 30 pounds (13.6 Kg.) had been noted in twelve months. At the same time, a dull aggravating pain had developed in the left scapular region. This pain was more or less constant but there were occasional exacerbations and although usually localized in the scapular region, the pain frequently projected around the left costal margin and down the inside of the left arm. The pain was aggravated by certain movements and by sneezing; occasionally it awakened the patient at night. There had been no cough, no hemoptysis, and to the knowledge of the patient, no fever.

The findings on physical examination were objectively negative except for the discovery of a small encrusted lesion on the lower lip which had been present for five years. Neurologic examination revealed no abnormality except that tilting of the patient's head caused pain in the lower cervical and upper dorsal regions, posteriorly. Roentgenologic examination of the dorsal and cervical portions of the spine gave, at this time, negative results. In the thorax, however, there was an infiltration of the first interspace and left pul-

monary apex with some thickening of the pleura suggestive of early adult tuberculosis. Laboratory tests including examination of the sputum and various agglutination tests gave negative results with the exception of the blood sedimentation test which showed a reading of 67 mm. in an hour (normal 20 mm.).

The lesion on the patient's lip was excised and proved to be squamous-cell epithelioma, grade 1. The patient was dismissed to follow a regimen of rest and was advised to return in three months for further observations of the pulmonary lesion.

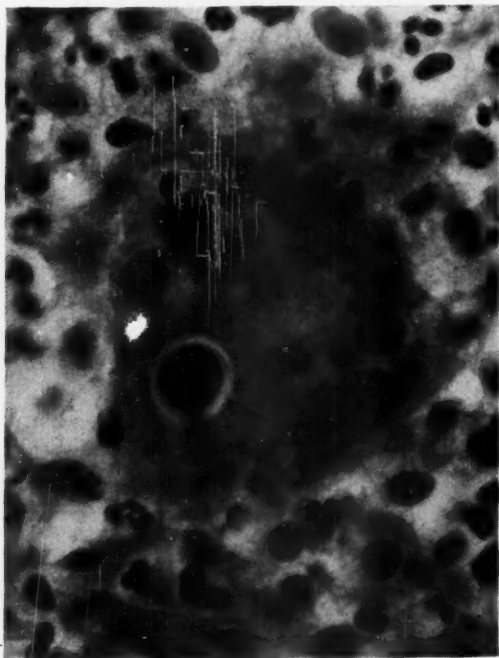


Fig. 1. Double-contoured "blastomycete" within a giant cell. Note the acute inflammatory exudate with polymorphonuclear leukocytes (hematoxylin eosin, x 600).

At the time of the patient's return on Dec. 27, 1939, he stated that following dismissal there had been considerable improvement in symptoms and in weight. In August, 1939, however, the pain had returned with increased severity, and with frequent exacerbations and with more definite and more persistent projection to the left arm and hand. Neurologic examination at this time gave evidence of sensory changes strongly suggestive of a lesion of the spinal cord, at the level of the first or second thoracic segment. Roentgenologic examination of the spine now showed an enlargement of the intervertebral foramen between the first and second thoracic vertebral bodies on the left with erosion of the corresponding transverse processes. These findings plus the presence of a soft tissue shadow in the left upper portion of the thorax were suggestive of a tumor of the left pulmonary sulcus or a dumb-bell neurofibroma.

Laboratory tests again gave negative results, except for the blood sedimentation in which a reading of 57 mm. per hour was obtained.

The pain had become so severe and progressive that operation seemed advisable. The bony erosion, as demonstrated in the roentgenograms, was suggestive of an intrathoracic and intravertebral dumb-bell neurofibroma.

Because of our experience with associated intrathoracic and intravertebral lesions, a combined operation was decided on. In previous similar cases, when

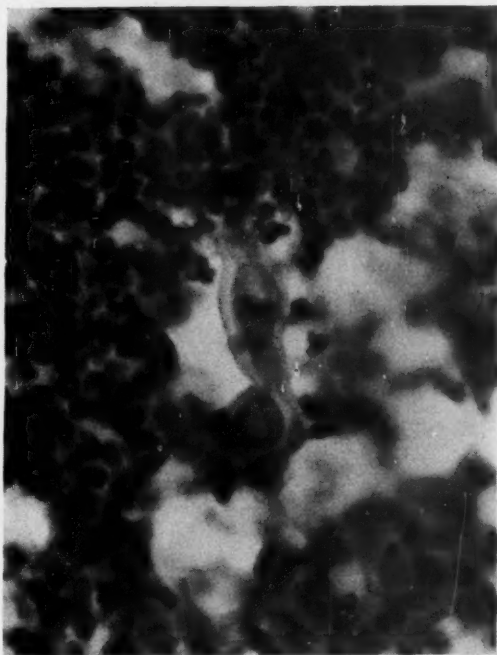


Fig. 2. Unusual picture of "blastomycete" in the process of budding (hematoxylin and eosin, x 600).

the combined intrathoracic and intravertebral operations have been carried out for the removal of tumors, laminectomy has been carried out first to determine the nature of the tumor, and thoracotomy, subsequently, the tumor being removed by means of the combined exposures.

For that reason the patient was given intratracheal ether anesthesia throughout the period of operation. The position on the operating table was a compromise between that usually used for laminectomy and that used for thoracotomy; the patient was placed on his side in about a three-quarters prone position. A left hemilaminectomy was then carried out, consisting of removal of the left laminae of the second and third thoracic vertebrae. An extradural tumor was uncovered which extended through the second thoracic intervertebral foramen; it was eroding the bone and compressing the nerve to such an extent that it was necessary to divide the nerve in order to attempt its removal. At first, the tumor appeared to be either a neurofibroma or a meningioma, but microscopic examination revealed tissue that was inflammatory

rather than neoplastic. It could be seen that the center of the mass was undergoing degeneration and there seemed to be a capsule which extended into the posterior mediastinum. The mass seemed to be about 5 cm. in diameter and its inner portion was removed with a curet. There was very little bleeding, and after the removal of the interior of the mass, the wound was closed and a small Penrose drain was inserted.



Fig. 3. Note the "fuzzy" character of the organism. Ten-day growth on nutrient agar at 22 degrees C.

Examination of the tissue fresh from the operating room and stained with polychrome methylene blue immediately established the diagnosis of an inflammatory process rather than a neoplastic one. The microscopic picture was that of a granulomatous lesion with a preponderance of polymorphonuclear leukocytes, and monocytes. Regions of necrosis were observed. Occasional giant cells of the Langhans type were noted and some of these contained one or more round or oval doubly-contoured bodies that varied in size but measured, on an average, about one and a half times the diameter of erythrocytes. These doubly-contoured bodies were also found in the tissue outside the giant cells. Budding was observed in these bodies both in stained sections and in unstained preparations that had been treated with 20 per cent sodium hydroxide.

The diagnosis of blastomycosis was strongly suspected on the basis of this early examination but because of the rarity of the lesion and its resemblance to tuberculosis, inoculation of guinea-pigs was ordered in addition to cultures for tubercle bacilli and blastomycetes. Examination of fixed frozen sections stained with hematoxylin and eosin entirely confirmed our suspicions of the preceding day with the demonstration of intracellular and extracellular doubly-contoured budding organisms in a granulomatous matrix (figs. 1 and 2). These organisms possessed all the characteristics described by others



Fig. 4. Healed incision a little to the left of the midline which allowed free access to the intraspinal and intrathoracic lesion.

as being typical of blastomycosis. Sporulation was not observed in any of the sections and the mucoid capsule described in connection with torulosis was absent. An unqualified diagnosis of blastomycosis was later substantiated by the finding of the organism in pure culture (fig. 3). No lesions developed in the guinea-pigs.

The patient was allowed out of bed on the twelfth day following the operation and was dismissed from the hospital on the fourteenth day with the wound completely healed (fig. 4). One course of radiotherapy was given over the upper thoracic region.

The patient returned two months after dismissal for a second course of radiotherapy. At this time his wound was found to be healed, he was completely free of pain, was eating well, sleeping normally and felt better than he had felt in many years.

## COMMENT

This case presented a very interesting and difficult problem from the standpoint of differential diagnosis. The conditions to be considered in the differential diagnosis were apical tuberculosis, malignancy of the apex of the lung (often so-called superior pulmonary sulcus tumor) and neurofibroma (dumb-bell type) involving the spine and mediastinum. Roentgenograms at the patient's first visit were suggestive of tuberculosis at the apex of the lung. The clinical and physical findings, however, did not substantiate this diagnosis as there were no respiratory symptoms such as cough or expectoration and no fever. Pain, weakness and loss of 30 pounds (13.6 Kg.) were more pronounced than one would expect of a tuberculous condition that was without very definite findings. The increased sedimentation rate was suggestive of an inflammatory lesion. At the second visit, the increased severity of the pain extending to the left arm and hand with sensory nerve changes was indicative of a lesion of the spinal cord. The roentgenograms of the spine were difficult to evaluate as they showed a destruction of bone suggestive of a malignant lesion and an enlargement of the intervertebral foramen with destruction of the pedicle simulating a dumb-bell neurofibroma of the mediastinum and cord. We felt that the clinical manifestations were more suggestive of a malignant tumor of the superior sulcus although there was no Horner's syndrome which is associated with only the more extensive lesions. However, the gain in weight which the patient had experienced since his previous visit and the enlarged intervertebral foramen which is not associated with malignant lesions made us hopeful that a benign neurofibroma was present.

The lack of response to conservative measures and the progressive character of the lesion justified surgical intervention. The operative approach was planned in such a way as to explore the spinal cord first because if the lesion were found to involve the cord, we believed it important to remove the cord lesion first. If the lesion extended into the mediastinum, the lesion could be removed at the same time or later, depending on the character of the lesion and the condition of the patient.

Blastomycosis, although a relatively rare condition, must be considered when dealing with any pulmonary lesion, but in this case there were no respiratory symptoms or cough to indicate pulmonary involvement. The most common symptoms of a systemic blastomycosis are cough, hemoptysis, thoracic pain and weakness, only two of which were present in this case, namely, pain extending into the arm, and weakness.

TABLE 1  
TISSUE DIAGNOSIS—DIFFERENTIAL POINTS

<i>Organism</i>	<i>Disease</i>	<i>Reaction</i>	<i>Cellular Products</i>	<i>Budding</i>	<i>Spores</i>	<i>Distribution of Lesions</i>
Blastomyces* dermatitidis	Blastomycosis	Acute, with polymorphonuclear leukocytes	None	Always	Never	Skin and generalized (lungs especially)
Coccidioides immitis	Coccidioidal granuloma	Acute, with polymorphonuclear leukocytes	None	Never	Always	Skin and generalized (lungs especially)
Debaromyces neoformans	Torulosis	Mild chronic	Mucoid material	Never	Never	Usually in brain, meninges

TABLE 2  
LABORATORY DIAGNOSIS—DIFFERENTIAL POINTS

<i>Organism</i>	<i>Disease</i>	<i>Organisms in Culture</i>			<i>Pathogenicity (animals)</i>
		<i>Mycelia</i>	<i>Asco-spores</i>	<i>Colonies</i>	
Blastomyces* dermatitidis	Blastomycosis	Always	Never (?)	Dry "fuzzy"	Slight or absent
Coccidioides immitis	Coccidioidal granuloma	Always	Never	Dry "fuzzy"	Marked (all laboratory animals)
Debaromyces neoformans	Torulosis	Never	Recently demonstrated <sup>10</sup>	Moist (mucoid)	Marked for rats and mice; slight for guinea-pigs (principally brain lesions)

\*The fungus "Zymonema dermatitidis" has been named by some as the etiologic agent in blastomycosis. However, because absolute proof of this is lacking, Henrici<sup>2</sup> and others are in favor of retaining this older term, manifestly inaccurate, but justified on the basis of usage.

From a review of the literature and from examination of our own material, it would appear that the three mycotic lesions of blastomycosis, torulosis and coccidioidal granuloma, although similar to one another in many respects, can be readily distinguished from one another. Tables 1 and 2 may prove useful in this regard.

The case reported fulfilled all of the necessary criteria for differential diagnosis listed under blastomycosis.

From the clinical side alone the present case provided features of unusual interest. Primary systemic blastomycosis is a rare disease; Martin and Smith accepted only sixty proved cases in an analysis of the literature prior to 1939. The first symptoms are pulmonary in half of the cases and at necropsy the lungs appear involved in more than 90 per cent of cases. Secondary, or metastatic, cutaneous lesions have been observed in practically every case

of systemic blastomycosis. In the case herein reported, pulmonary symptoms were entirely absent and the only cutaneous lesion present was an independent one, a squamous-cell carcinoma of the lip which on careful histologic study proved to contain no blastomycetes. The primary neurologic manifestations in this case were also very unusual. In a survey of the literature we have not been able to find another instance in which the primary manifestations of a blastomycotic lesion have simulated those of a tumor of the spinal cord.

#### SUMMARY

We have presented a case of systemic (pulmonary) blastomycosis in which the primary clinical manifestations were those of irritation of the nerve roots of the dorsal portion of the spine, and in which cutaneous lesions were absent. Isolation of the causative organism and hence, the ultimate diagnosis of the lesion was made possible by the technic of rapid frozen section employed at the time of operation. A brief review is given on points that distinguish blastomycosis from coccidioidal granuloma and from torulosis.

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# The Southern Surgeon

*Published Monthly by*

*The SOUTHERN SURGEON PUBLISHING COMPANY*

701 Hurt Building

ATLANTA

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Subscription in the United States, \$5.00

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VOLUME IX

OCTOBER, 1940

NUMBER 10

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## A BRITISH DOCTOR'S STORY

In this whirring world where events of a day or week profoundly alter the lives of a whole nation, it is illuminating to consider medical practice in Blitzkrieged England. The following quotations from a letter written in July 1940 by R. Watson-Jones of Liverpool present an uncommonly complete picture of the daily life of a prominent surgeon:

"Blood and sweat; toil and tears; that is our privilege for the moment. Never before have we been faced with a greater task; never before have we been more resolutely determined to accomplish it. One by one our friends and allies have been beaten down, some 'rotten within before they were smitten without,' each overwhelmed in turn. Week by week, one more language has disappeared from the air. The dialling boards of wireless sets enhance the illusion of isolation, for now there are but two transmissions—ours and theirs. Nevertheless we are isolated. We may have our backs to the wall, but what a wall! The Atlantic and our good friends beyond the Atlantic—our friends who believe with us in truth, in freedom, and in tolerance. . . .

"We will win. Whatever the cost, whatever the hardship, whatever the pain, by hard fighting, hard living, hard working, we will win. Why am I sure of that? *Posse quam posse credunt*. They can, because they think they can. . . . There is no panic—not a trace, not a sign—no fear, no emotion, no anxiety; just a cold disciplined determination. The many months of vigil, when the worst has been expected day by day and every day, the continued wearing which may be more difficult to bear than acute stress, the blackout precautions, air raid drills, and ambulance practices, the blast pro-

tection of windows, buttressing of walls, propping of ceilings and layering of sand on upper floors, the blockading, ditching, staking, mining of parks, fields, beaches and roads, the converting of garden lawns into vegetable patches, the minor annoyances of food, drink, fuel and petrol rationing, the digging of underground shelters, the fitting of gas masks, the wearing of indestructible identity discs, the testing of blood groups, the stocking of blood banks, the suffering of those whose sons, brothers, and husbands will not return, all these insanities have hardened and strengthened the men and women of this country. The wife of a doctor friend of mine, a girl who seems frail and very feminine, whose home is broken up, financial resources gone, child dead, and husband now in an Army Hospital with head and chest injuries, wrote yesterday to my wife, 'Goodness me, I am knocked from pillar to post, and the more knocks I get the calmer I become, which astonishes even me'...

"I have been appointed Civilian Consultant in Orthopedic Surgery to the Royal Air Force, and been given the honour of organising their fracture service. Three, four or more days each week I spend flying or motoring from one Air Force Hospital to another—consulting, organising, operating—treating youths and men who are the cream of the land, men who are intensely grateful for all that is done, who are desperately keen to get fit and back to their jobs. The R. A. F. Hospitals are scattered over the country, but I have developed a plan for the early transport of bone and joint injuries to a certain number of specially prepared fracture hospitals. Each of these is now staffed by trained orthopaedic as well as general surgeons; each has the finest equipment, twin operating theatres, high powered radiographic units and every modern traction device; each has a gymnasium and swimming pool for rehabilitation. Active exercises begin at once, and at every hour of the day the signal goes up for five minutes hard work. In one ward, the 'exercise leader' is an air gunner with bilateral compound comminuted fractures of the humerus and elbow joint, and bilateral burns of forearms, hands and fingers. His enthusiasm as he waves his tannic blackened fingers in the air, qualifies him to be the leader of that ward, and which of them can resist the stimulus of his example? The final stages of rehabilitation are completed at certain seaside resorts where nine hole approach courses, putting greens, croquet lawns, squash courts, tennis courts, billiard and table tennis rooms, indoor and outdoor swimming pools are available. How much more valuable is the equipment of recreational activity by which joints are mobilised in the course of an interesting pursuit, than the equipment of physiotherapy and electrotherapy which tends to focus attention on the joint? Competitive games and recreations will shortly be organised, by the trainer of one of the most successful Football Clubs for the

men, and by the Captain of one of England's Test Cricket teams for the Officers. . . .

"Prophylactic chemotherapy has been employed in compound and gunshot fractures for a considerable time, but I believe that it is still too soon to judge the relative merits of sulphanilamide powdered into the wound and the same preparation given by mouth or injection; and also too soon to know how much better prophylactic chemotherapy may be, than chemotherapy instituted at the first sign of infection. Blood banks, so recently developed, threaten to be replaced by dried plasma. It is now as easy to call for a pint of blood as for a quarter of morphine. Each is kept in the doctor's bag. The battle cruiser and destroyer can now carry blood, immune from the danger of glass breakage. . . .

"Shrapnel and gun shot wounds, streptococcal and gas gangrene infections, sulphanilamide and sulphathiazole, primary and secondary haemorrhages, Winnett Orr no-dressings plasters (or as they will to my annoyance call them—Trueta plasters) are not engaging the whole of our attention. Civilian practise is going on. Even bunions must be relieved, flat feet manipulated, congenital hips reduced, and osteoarthritic hips arthrodesed. . . . Retropulsed discs and hypertrophied ligamenta flava are regularly removed even here in Liverpool, the home of that enthusiastic student, but misguided arm-chair critic, Papworth. . . .

"If this letter is too short, too long, or in any way below the usual standard, blame the Nazis, for the drafting of it has now witnessed two air raids. At this moment as I write, although it is a crisp, bright Sunday afternoon, apparently so peaceful and warm with the midsummer sun, the anti-aircraft guns are firing and the drone of bombers can be heard. We carry on unconcernedly, but prepared at any moment to dive underground, if events 'hot up.' The children are playing on the lawn, a good part of which is lawn no more, for though the background of roses and clematis remains, the foreground consists of potatoes, onions, and chickens. They are playing their favorite game—'air raid warnings.' One cries the blood-curdling wail of the sirens; the rest rush for their 'shelter,' where blankets, sticks and playboxes take the place of reinforced concrete and sandbags. My own two, aged six and eight, display their unconcern by often retiring to bed at night with ears already plugged with wool, dressing gowns and shoes already on, dolls already so comfortably arranged in the dugout, ready to save time in the night when warnings may sound. What a life! . . ."

This, I think more eloquently describes life in England than all the news reports I've seen. It shows incidentally our prospects if the English are allowed to fall to Benny, and Adolph, and Joe.

—WALTER G. STUCK, M. D.

## SECTIONAL MEETINGS, 1940

In those States where they have been tried, Sectional Meetings of The Southeastern Surgical Congress have met with a warm reception and have proved their value. At the date of going to press, the following meetings had been reported:

The Seventh Annual Clinical Conference of the Florida Section was staged in Miami, August 31, at the Jackson Memorial Hospital. As is the custom at such meetings, no formal papers were presented and the discussion was general. Here is the program:

Carcinoma of the Stomach, Dr. Edward Jelks, Jacksonville  
Genital Displacements in the Female, Dr. B. T. Beasley, Atlanta  
Skin Grafts, Dr. William G. Hamm, Atlanta  
Complications of Peptic Ulcer, Dr. R. L. Sanders, Memphis  
Breast Tumors, Dr. T. C. Davison, Atlanta  
Medical Care of the Surgical Diabetic, Dr. L. M. Limbaugh, Jacksonville  
Surgical Phases of Lung Abscess, Dr. Herbert Acuff, Knoxville  
Upper Urinary Tract Infections with Diagnosis and Treatment, Dr. C. F. Lewis, Birmingham.

The Georgia Section convened at the Bulloch County Hospital in Statesboro on September 11. The Clinical Conference conflicted with the statewide primary which cut down the attendance, but the enthusiasm of those who came was stimulating. The program:

Nephrolithiasis, A Sectional Problem, Dr. John Mooney, Jr., Statesboro; Discussion opened by Dr. Edgar G. Ballenger, Atlanta

Ruptured Duodenal Ulcer, Dr. J. H. Whiteside, Statesboro; Discussion opened by Dr. Fred Waas, Jacksonville

Neurosurgery, Dr. R. L. Cone, Statesboro; Discussion opened by Dr. Charles E. Dowman, Atlanta

Compound Fractures with Gas Bacillus Infection, Dr. P. H. Smith, Savannah; Discussion opened by Dr. C. F. Holton, Savannah

Carcinoma of the Uterus, Dr. A. J. Mooney, Sr., Statesboro; Discussion opened by Dr. J. K. Quattlebaum, Savannah

Cesarean Section, Dr. Louis Kennedy, Metter; Discussion opened by Dr. E. A. Wilcox, Augusta

Acute Appendicitis with Drainage, Dr. Bird Daniel, Statesboro; Discussion opened by Dr. Edward Jelks, Jacksonville

The Role of the Liver in Surgical Patients, Dr. C. Thompson, Millen; Discussion opened by Dr. Herbert Acuff, Knoxville.

In addition to the clinical discussions, Dr. J. C. Patterson, of Cuthbert, addressed the meeting on "The Educational Value of Rural Meetings of The Southeastern Surgical Congress," and at the luncheon Hon. Dave Turner, editor of the Bulloch Times, Dr. B. T. Beasley, and Dr. Allen H. Bunce, President-Elect of the Medical Association of Georgia, made short talks.

The Tennessee meeting was held in Shelbyville on September 17. This Section was honored with an address of welcome by the Governor of the State, the Honorable Prentice Cooper. Dr. B. T. Beasley also spoke on "The Southeastern Surgical Congress: Its Place and Purpose." The program:

Hematuria and Pyuria, Case Presentations by Dr. Price Womack, Shelbyville, Dr. E. S. Leek, Bell Buckle, and Dr. J. C. Pennington, Nashville; Discussion opened by Dr. Edgar G. Ballenger, Atlanta

The Peptic Ulcer Problem: Case Presentations by Dr. Harrison J. Shull, Shelbyville, Dr. Matt Murphree, Murphreesboro, and Dr. J. M. King, Tullahoma; Discussion opened by Dr. R. L. Sanders, Memphis

Problems of the Mammary Gland: Case Presentations by Dr. M. L. Connell, Wartrace, Dr. James N. Burch, Shelbyville, and Dr. J. N. Boykin, Lewisburg; Discussion opened by Dr. Carl R. Crutchfield, Nashville

Thyroid Syndrome: Case Presentations by Dr. S. S. Moody, Shelbyville, Dr. W. H. Avery, Shelbyville, and Dr. J. F. Adams, Woodbury; Discussion opened by Dr. N. S. Shofner, Nashville

Management of the More Common Types of Fractures: Case Presentations by Dr. B. L. Burdette, Shelbyville, Dr. Albert Farrar, Shelbyville, and Dr. Ben Marshall, Fayetteville; Discussion opened by Dr. Troy Bagwell, Knoxville.

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#### THE TEXAS SURGICAL SOCIETY

announces its fall meeting  
to be held in the Rice Hotel, Houston  
October 7 and 8

The program is as follows:

DR. T. H. THOMASON, *Fort Worth*  
*Pancreatic Lithiasis with Diabetes*

DR. A. W. ADSON, *Rochester, Minn.*  
*Diagnosis and Treatment of Neuralgia of the Face*

DR. R. J. WHITE, *Fort Worth*  
*Fatal Abdominal Wall Infection Following Appendectomy*

DR. G. W. N. EGGERS, *Galveston*  
*Ankylosis of the Mandible*

DR. M. W. SHERWOOD, *Tempe*  
*The History of Limited Surgical Societies*

DR. MAXWELL HARBIN, *Cleveland, Ohio*  
*Surgery of the Knee Joint*

DR. HERBERT HAYES, *Houston*  
*Cancer of the Rectum, Sigmoid and Anus*

DR. H. W. COCHRAN, *Houston*  
*X-ray Diagnosis of Intestinal Obstruction*

DR. H. A. O'BRIEN, *Dallas*  
*Cutaneous Ureterostomy*

DR. A. O. SINGLETON, *Galveston*  
*Cancer of the Rectum*

DR. GEO. R. ENLOE, *Fort Worth*  
*Gastric Obstruction in Infants*

DR. C. C. NASH, *Dallas*  
*Intraventricular Tumors*

## BOOK REVIEWS

*The Editors of THE SOUTHERN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The Editors do not, however, agree to review all books that have been submitted without solicitation.*

**THE INJURED BACK AND ITS TREATMENT.** Edited by JOHN D. ELLIS, M. D. Contributing Authors: H. EARLE CONWELL, M. D., Birmingham; LOYAL DAVIS, M. D., Chicago; NATHAN S. DAVIS, III, M. D., Chicago; JOHN D. ELLIS, M. D., Chicago; RALPH K. GHORMLEY, M. D., Rochester; HALE A. HAVEN, M. D., Seattle; Professor SIR ARTHUR KEITH, F.R.C.S., F.R.S., London; ROBERT B. OSGOOD, M. D., Boston. 377 pages, with 17 illustrations. Price, \$5.50. Springfield and Baltimore: Charles C Thomas, Publisher, 1940.

Back injuries are commonly encountered by all surgeons but the variety of symptoms, the overwhelming literature on the subject, and the highly controversial aspects of it generally produce hopeless confusion. This volume presents its views in such an orderly analytical manner that much of the confusion is dispelled. Its absence of axe-grinding and its fair-minded evaluation of present knowledge makes it one of the most lucid dissertations on this subject.

The opening chapter on "The Evolution of Man's Posture" by guest author Sir Arthur Keith provides a sound understanding of the physiology of the spine and its reaction to injury. The emphasis on the lumbar curve which man alone possesses readily explains many of the structural predisposing causes of backache.

In the second chapter, Dr. Nathan Davis of Northwestern gives a thorough description of the manner in which visceral diseases can cause backache and thus confuse diagnosis and treatment of spinal lesions.

Chapter III, "Routine Examination of the Injured Back" by John D. Ellis brings into one place all the accepted differential diagnostic methods of determining the seat of pathologic changes. It makes clear that Goldthwaite's all-encompassing conception of sacro-iliac strain was satisfactory as far as it went but that there is much more to the problem than was first supposed.

Chapter IV by Conwell of Birmingham is an excellent discourse on "The Treatment of Fractures of the Spine." It is comprehensive and at the same time direct in its recommendations.

Loyal Davis and Hale Haven have written Chapter V on "Neuro-Surgical Aspects of Spine Injuries." Everyone who sees fractures of the spine needs this information to guide him when cord injuries are present; because paralyses, "cord bladder" and other complications are seldom adequately treated.

Ralph Ghormley of the Mayo Clinic presents in Chapter VI the "Role of the Articular Facets in Low Back Pain." His special interest in new x-ray technics to delineate the intervertebral joints and his pathologic studies of these joints admirably fit him to speak with authority on a new approach to this problem.

Chapter VII on "Faulty Body Mechanics" by Robert Osgood clearly points out that visceroptosis, bad posture, and failure in life are usually coexistent. Conversely good posture is shown to be a great preventive of back injury of all types.

Chapter VIII "Relation of Trauma to Diseases of the Spine" by Ellis is of special medicolegal value since this relation is constantly argued in compensation cases.

And finally, Chapter IX by John Ellis discusses "The Treatment of Minor Injuries of the Spine." Like the rest of the book it is conservative while describing the most efficient surgical care of back injuries. Herniation of the nucleus pulposus, thickening of the ligamentum flavum and other recent developments of this subject are analyzed fairly and cautiously.

The book is unique among surgical monographs in its thoroughness and lack of padding. An amazing mass of information on this broad subject is compressed into its relatively small bulk. Such volumes render invaluable aid to the doctor who is trying to separate wheat from chaff in a large and important field of medicine.

—WALTER G. STUCK, M. D.

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NEOPLASTIC DISEASE. A TREATISE ON TUMORS. By JAMES EWING, A. M., M. D., Sc. D., LL. D., Professor of Oncology at Cornell University Medical College, New York City; Consulting Pathologist, Memorial Hospital. Fourth Edition, Revised and Enlarged. 1160 pages, with 581 illustrations. Price, \$14. Philadelphia and London W. B. Saunders Company, 1940.

It isn't necessary for THE SOUTHERN SURGEON to heap encomiums on Ewing's Neoplastic Diseases. For twenty-one years this book has been the bible of surgeons and others interested in tumors. It has long been recognized as an indispensable reference. We do feel justified in bringing to the attention of our readers that after a lapse of twelve years a new edition has appeared. Contributions in physics, chemistry, physiology and genetics, as well as in general pathology and clinical medicine have made necessary extensive revision and indeed complete rewriting of some chapters. The up-to-date surgeon needs a copy of the 1940 edition.

**Have YOU returned your questionnaire to the Medical Preparedness Committee of the A. M. A.?**

It is surprising to learn that a large proportion of the doctors of the country have not voluntarily returned their blank to the American Medical Association. Any doctor who has misplaced his original form can secure a duplicate by addressing The Editor of The Southern Surgeon, 104 Ponce de Leon Ave., N. E., Atlanta, Ga.

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